SOLID WASTE MANAGEMENT
PRINCE EDWARD ISLAND

A Report With Recommendations

SOLID WASTE MANAGEMENT DIVISION
PRINCE EDWARD ISLAND ENVIRONMENTAL CONTROL COMMISSION

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ENVIRONMENTAL CONTROL COMMISSION

P.O. BOX 2000

CHARLOTTETOWN, P.E.I.

Mr. A. J. Hiscock
Chairman
Environmental Control Commission

The accompanying report is submitted in response to your directive of January, 1973, to the Air & Solid Waste Management Division.

The report deals with the status of solid waste management in the province and provides recommendations for your consideration.

Respectfully submitted,

W.C. Phillips

W.C.PHILLIPS
Director
Air & Solid Waste Management

SOLID WASTE MANAGEMENT
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CHAPTER 1

1. SUMMARY & RECOMMENDATIONS:

1.1. Abstract:

This report reviews solid waste management in the Province and predicts that the estimated current generation of 60,000 Tons of combined household and commercial refuse will increase at a rate of 7% every five years.

A lack of understanding and concern by the general public, inadequate financing and relaxed regulations, are cited as the basic factors which have created the province's present over abundance of poorly maintained and unsightly dumps.

While first priority is given to domestic and commercial refuse, the report recommends that generators be held responsible for waste management and be required to meet standards established by the Provincial Government.

The report recommends the establishment of a system of refuse collection for all municipalities and some thirty refuse container sites for rural areas, with transfer of all refuse to four regional sanitary landfill disposal sites. The program is anticipated to require two years for implementation and is estimated to cost 1.4 million dollars per year.

1.2 Summary:

1.2.1 Present Problems:

Solid waste management problems, while not unique to Prince Edward Island, have reached a critical state as evident by the increasing large number of roadside promiscuous dumps and the unsightly and hazardous condition of community and municipal dumps.

The general lack of concern of many residents, and the inability of local elected officials to provide the necessary facilities or financing for adequate waste management, combined with the increasing quality of refuse generated, are considered to be the major factors.

It is estimated that Islanders spend less than one dollar per capita per year on the average for waste disposal, a figure well below that required to provide an environmentally acceptable method.

The incinerator sites serving Charlottetown and Summerside are outmoded and overtaxed. (Burning is not complete). The resulting fly-ash, smoke, and odors are increasingly objectionable and do not comply with the Province's air quality objectives.

Dumping practices in rural communities and most municipal areas, have resulted in an increase in roadside dumps for household and farm wastes. These dumps are generally uncontrolled and hazardous. They become breeding grounds for flies, rodents, and other undesirable vectors,

providing a very real hazard for the spread of both human and agricultural diseases.

Several municipalities and rural communities have made efforts to improve access to sites, restrict operating times and provide a degree of supervision and maintenance. Generally, however, the attitude prevails that it is a "government" responsibility.

Several provincial government programs are in existence including, a grant of $150 to assist communities in establishing disposal sites. A maintenance program to provide equipment for clean up and burial twice yearly at over fifty "community" disposal sites. A potato burial program which provides free on-site burial of potato culls in excess of ten tons. A derelict vehicle program which provides free removal and disposal of old car bodies on request.

In many cases because initiative for the site location rests with local people, the establishment grants have been applied to sites which were out of the way, with poor access and on land which was not capable of satisfactory waste disposal.

Although numerous sites have been established, the distribution has not been adequate to provide the necessary coverage for rural areas. The established sites invariably degrade to garbage piles as a result of a lack of management and concern by their users; and the provincial maintenance program, without the cooperation of local management, cannot cope in its present form.

A number of provincial and municipal regulations exist which deal with waste disposal including the Highway Traffic Act, the Summary Trespass Act, the Unsightly Premises Act, the Environmental Control Commission Act, the Agricultural Chemicals Act, the Public Health Act, the Town Planning Act, the Fish & Game Protection Act. None of these Acts deal with waste disposal adequately or in sufficient detail to provide a sound basis for a management program. There are many instances of duplication of jurisdictions and contradiction of requirements.

1.2.2 Conclusions:

It is evident that the current problems of solid waste management have reached proportions which can no longer be handled by old methods. The public in general has demonstrated a reluctance and an incapability to cope with the situation, as have most municipalities. The Province suffers from the lack of environmentally acceptable standard of waste management and a co-ordinated approach to waste handling and disposal.

The future of this Province both as a desirable place to live and a desirable place to visit is dependent on the continued development and maintenance of its pleasant and relatively pollution free environment. However, unless significant corrective action is taken in the development and implementation of a province-

wide solid waste management program, the present less than desirable situation will rapidly worsen with extremely high remedial costs.

Inadequate disposal methods of domestic, commercial, institutional and miscellaneous wastes are recognized as creating the major problems. Present generation rates of these wastes are estimated at 62,748 tons per year and will increase at a rate of 1.2% per year.

Various methods of re-use and recycling were reviewed but found to have no significant practical application. Sanitary landfill is recognized as the single practical method of disposal.

The Province's preponderance of poorly managed and controlled refuse disposal sites should be cleaned up and closed, in preference to a managed system of waste disposal which reflects a firm government policy, and is supported by comprehensive legislation.

While provincial assistance programs have been effective in the areas applied, present conditions indicate that more comprehensive action is required. It is recommended that the provincial government provide waste management on behalf of the various municipalities and for rural areas which, in lieu of county government, falls within provincial jurisdiction.

1.3 Recommendations:

1.3.1 Responsibilities and Standards:

The development and implementation of a solid waste management system is dependent on the definition and acceptance of responsibilities.

In general, waste producers, individuals, municipalities, and corporations must be made ultimately or directly responsible for the satisfactory disposal of the wastes they produced.

The central provincial government is ultimately responsible for establishing a standard of waste management in the province. The reader is referred to Section 5.2 of this report where minimum standards are outlined. The acceptance of these standards are recommended as a necessary prerequisite to the development, implementation, and enforcement of a safe and environmentally acceptable means of solid waste disposal.

Municipalities, must be held responsible for providing a safe, convenient method of disposal of wastes generated in their jurisdictions.

Where a system of waste management, for reasons of uniformity and efficiency, as this report recommends, requires province-wide management and consolidation of administration of a central level, it is recommended that the provincial government find within its means, an agency to accept this responsibility.

1.3.2 Management System:

Household, commercial and institutional wastes were recognized in this study as being the principal contributors to the waste problem, and also as being the most difficult area of waste to control. While wastes from production, processing and manufacturing are more easily defined and controlled by dealing with individual operators as producer groups, domestic, commercial and institutional wastes are of general similar character and are produced by everyone.

This report proposed a province-wide basic system of domestic, commercial and institutional waste management. A significant feature of the program is that a level of service is provided to all and by its availability will be used to bring about the required objectives.

The system provides for:

1. A Province-wide disposal system utilizing four regional sanitary landfill sites provides the most preferable management system when operated in conjunction with,
2. weekly curb-side collection for domestic refuse, and twice-weekly container collection for commercial and institutional wastes, generated within incorporated municipalities, and
3. a system of bulk container refuse transfer sites for local domestic refuse, located so as to provide "disposal" within five miles of 90% of

the province's rural residents. Approximately thirty such container sites will be required.

The total cost of this system is estimated to be $1,317,500 per year. This cost may be considered as $6.62 per capita for household refuse at a rate of approximately $25 per Ton, with a further cost for commercial and institutional refuse at a rate of approximately $17.50 per Ton.

1.3.3 Implementation:

In preparing this report, it has been necessary to make approximations where detailed information was not available. It will therefore be necessary to continue investigation in some areas before a detailed process of implementation can be devised. The study is competent, however in recognizing the preference of collection and contain rization and in the operation of regional disposal sites in preference to numerous local sites, including the approximate most efficient location of the regional sites.

An important concept and requirement of the program is that province wide service is provided by a province wide application of the system. As a result, overall efficiencies of equipment and manpower, etc. are achieved and the varying regional cost differentials are equalized. The program efficiencies will not be achieved without overall application.

It is therefore evident that centralized administrative control must be provided to ensure the maintenance of a level of service and the equity of cost. This may be accomplished by a single private agency, a commission, or more logically by a single agency of government.

Acceptance of the recommended management system and the standards to be maintained is required so that activities of both the private and public sectors may be directed to achieve a predetermined objective.

It should be noted that the nature and scope of this program suggests the possibility that established waste management companies may be interested in providing proposals for implementing such a scheme. This Division has been advised of the interest of several local contracting firms in submitting proposals and it is recommended that they be encouraged to do so.

It is estimated that a period of approximately two years will be required to fully implement the program.

As a general guide, the implementation process should reflect the considerations and requirements of people to be served, in particular, the municipalities and commercial operators. It should also reflect the proposals of potential contractors and include insofar as practical, waste management operations which are currently in practice.

Initial implementation should include the following activities.

- detailed evaluation - selection of potential regional disposal sites and transfer stations.
- development of collection routes
- develop necessary administrative unit
- establish a demonstration sanitary landfill operation
- develop information program to inform and receive public expression
- close restriction to establishment of any further refuse disposal sites.
- program of phasing out unnecessary sites

- upgrading and extending service of necessary sites
- encourage proposals of waste management operators
- develop and implement guide line - requirements and approval system for major waste generating operators including agriculture, fisheries and industry
- develop and implement general waste management regulations related to normal or less than major operations

1.3.4 Financing:

This program will require an annual expenditure of approximately 1.4 million dollars, of which in the order of 70% will be monies over and above current expenditure.

The average cost of services per household is estimated to be $31 per year. To ensure acceptance of the program and the availability of service at a reasonable cost, it is recommended that the province participate in the financing in the amount of 50% of the total cost. The balance to be financed through a combination of "user charge" and assessment.

CHAPTER 2

2. INTRODUCTION:

2.1 Objectives:

In January 1973, the P.E.I. Environmental Control Commission met with the Provincial Planning Board to report on the present status of Solid Waste Management and to discuss means of bringing about a more satisfactory method of handling the ever increasing problem. As a result of this meeting, this Study was commissioned.

The Terms of Reference for the Study briefly stated were to review all forms of Solid Waste generated in the Province and prepare recommendations for alternate management systems which would be socially, economically and environmentally acceptable to the Province. Consideration should be given to responsibilities of both government and private sector.

The Environmental Consulting Firm of MacLaren Atlantic Ltd. was selected to provide general guidance and specific expertise as necessary.

2.2 Method and Scope:

Early in the Study, it became evident that while the Province had a need for both Policy and Program for all forms of solid waste, the most significant overall problems resulted from refuse generated by individuals in natural situations. As a consequence this Report deals primarily with a management solution

for household, institutional and commercial refuse.

Interviews were designed and carried out to provide information on quantity and type of refuse generated, present and proposed methods of management and impressions, opinions and advice of a wide variety of people.

Waste quantities derived from the various generation sectors; domestic, commercial, institutional, industrial, etc., were developed and allocated to the areas of their generation providing a province-wide distribution.

Various alternative components of solid waste management systems were reviewed and analyzed for their applicability to the Province. Cost estimates were then developed and analyzed for the appropriate alternate functions.

The legal implications were then considered to provide the guidelines and policy recommendations for those amendments to present legislation as necessary to facilitate the program.

CHAPTER 3

3. SOLID WASTE:

3.1 Solid Waste Composition:

For the purpose of this report, solid waste may be considered to be any solid refuse mater: l.

The percentage composition of refuse may vary considerably for industrial refuse; while domestic, commercial and institutional refuse remains reasonably constant in the proportions presented in Figure 1.

Figure 2 provides a division of refuse material into classifications relating to composition and source.

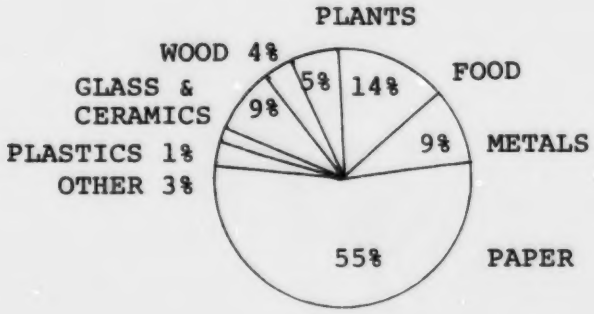


FIGURE 1

PERCENTAGE COMPOSITION OF REFUSE

3.2 Solid Waste Generation:

Before comprehensive considerations of waste managements could be made, it was necessary to prepare a realistic appraisal of the amount of

Refuse (Solid Wastes)	Garbage	Wastes from the preparation, cooking, and serving of food Market refuse, waste from the handling, storage, and sale of produce and meats		From: households, institutions, and commercial concerns such as: hotels, stores, restaurants, markets, etc.
	Rubbish	Combustible (primarily organic)	Paper, cardboard, cartons Wood, boxes, excelsior Plastics Rags, cloth, bedding Leather, rubber Grass, leaves, yard trimmings	
		Noncombustible (primarily inorganic)	Metals, tin cans, metal foils Dirt Stones, bricks, ceramics, crockery Glass, bottles Other mineral refuse	
	Ashes	Residue from fires used for cooking and for heating buildings, cinders		
	Bulky Wastes	Large auto parts, tires Stoves, refrigerators, other large appliances Furniture, large crates Trees, branches, palm fronds, stumps, flotage		From: streets, sidewalks, alleys, vacant lots, etc.
	Street refuse	Street sweepings, dirt Leaves Catch basin dirt contents of litter receptacles		
	Dead animals	Small animals: cats, dogs, poultry, etc. Large animals: horses, cows, etc.		
	Abandoned vehicles	Automobiles, trucks		
	Construction & Demolition wastes	Lumber, roofing, and sheathing scraps Rubble, broken concrete, plaster, etc. Conduit, pipe, wire, insulation, etc.		
	Industrial refuse	Solid wastes resulting from industrial processes and manufacturing operations such as: food-processing wastes, boiler house cinders, wood, plastic, and metal scraps and shavings, etc.		From: factories, power plants, etc.
	Special wastes	Hazardous wastes: pathological wastes, explosives, radioactive materials Security wastes: confidential documents, negotiable papers, etc.		Households, hospitals, institutions, stores, industry, etc.
	Animal and Agricultural wastes	Manures, crop residues		Farms, feed lots
	Sewage treatment residues	Coarse screenings, grit, septic tank sludge, dewatered sludge		Sewage treatment plants, septic tanks

FIGURE 2

CLASSIFICATION OF REFUSE MATERIAL

the various types of refuse generated, the locations of generation and the factors influencing that generation.

Interviews were carried out with all major solid waste producers and management officials including municipal officials, refuse collectors, plant operators and various government agencies. In many cases because of the lack of records, it was not possible to accurately establish a historical or present rate. Consequently, it was necessary to use rates and trends from comparable areas documented by other Studies.

3.3 Categories of Waste:

For the purpose of this Study, refuse is considered in two general categories. The first are wastes which are generated by people in normal situations. They are a function of people and can be expressed and distributed as a per capita generation quantity. Refuse included in this category are primarily household or domestic, commercial and institutional, and are the wastes identified as creating the bulk of the Province's management problems.

The second category of refuse is not generated on a per capita basis. It is dependent on a specific type of production, or land use and includes wastes from industry, production, and processing.

3.3.1 First Category Waste Generation:

Refuse entering the Charlottetown disposal site was

weighed for two periods, each of two weeks duration, during March and August of 1972. Figure 3 presents a summary of the weights and fluctuations of two major source divisions: Domestic & Commercial.

	LBS/CAPITA/DAY		
	SUMMER	WINTER	AVERAGE
RESIDENTIAL:			
Charlottetown	1.2	1.3	1.25
Sherwood	.9	1.4	1.15
Parkdale	2.0	1.2	1.6
COMMERCIAL:			
Charlottetown	2.6	2.1	2.35
Sherwood	1.9	1.5	1.7
Parkdale	1.7	2.7	2.2

FIGURE 3

SUMMARY OF CHARLOTTETOWN WEIGHINGS
MARCH & AUGUST, 1972

As a result of the Charlottetown weighings and other sources, the following generation rates were established.

Types	Generation Rate 1972
Domestic	1.3 lbs./person/day
Commercial	2.1 lbs./person/day
Institutional:	
Schools	0.5 lbs./person/day
Hospitals	5.0 lbs./bed/day
Other:	
Municipal	0.1 lbs./person/day
Tourism	1.3 lbs./person/day

3.3.2 First Category Waste Distribution:
These wastes were then distributed proportionately throughout the Province on the basis of present and predicted population projections supplied by the Department of Development. (These population projections appear in Table I). The resulting tabulation of waste generations from domestic, commercial, tourist and institutional refuse is presented in Table 2.

3.3.3 First Category Generation Projections:
Future generation rate increases are difficult to predict. However, considering the economical and social change projections, an increase of 7% per five years increment was established for domestic and commercial refuse throughout the Province. This rate of increase compares favourably with projections for other areas in the Maritime region and has a satisfactory parallel with national projections as seen in Figure 4.

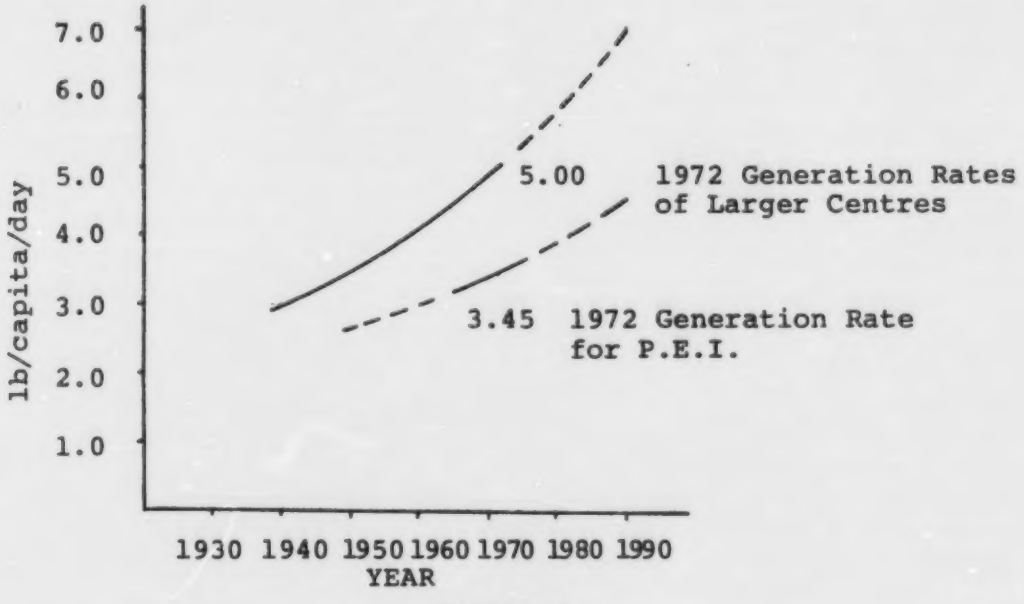


FIGURE 4

REFUSE PRODUCTION PER CAPITA

A projection of future refuse generation was then developed by combining the population projections with estimated rates of generation. The total estimated quantities of first category refuse generation for various time periods are summarized in Table 2.

3.3.4 Second Category Waste Generation:
As previously mentioned, interviews with plant operators, though helpful, did not often yield factual data because of lack of records.

Quantities of wastes for the two major sources in this category, agricultural (production and processing) and fish processing were established in proportion to production and allocated to the areas of generation. These quantities are presented in Table 3 as industrial waste generation.

Agricultural production wastes were considered to consist mainly of potato culls, generated at a rate of 10% of total crop, of which approximately 70% or 3,500 tons require disposal.

Agricultural processing including vegetable and meat process and packing were found to have widely varying waste production rates; as high as 60% of raw material produced for potatoes, and as low as 2% for special crops such as strawberries.

Fish process wastes were estimated at 60% of landings for groundfish and 20% for pelagic and

crustaceans. The latter two being adjusted for whole fish exported directly.

Other miscellaneous wastes such as those from the manufacturing industries and lumbering operations were found to be in small quantities and normally disposed of by satisfactory means and were therefore considered not significant to this Report.

3.3.5 Second Category Waste Generation Projection:

It was not possible at the time of this Study to develop a significantly accurate forecast of future waste generation.

CHAPTER 4

4. PRESENT PRACTICES AND INHERENT PROBLEMS:

4.1 General:

Solid waste problems are not unique to this Province. The rapid increase in production of waste materials stimulated by our "throw away philosophy" and rapidly changing merchandising techniques have created new dimensions in universal solid waste management problems.

While Islanders, as individuals, do not appear to be less concerned than their counterparts in other provinces, regarding minor refuse practices such as littering, there does however appear to be a significant lack of concern for refuse and refuse management in general. The rapid increase of refuse generation has now reached such proportions which can no longer be handled by the old methods. In the past, adequate funding for proper operation and maintenance of waste management facilities have not been provided.

The results are poorly managed "community and municipal dumps" and a multitude of "promiscuous" dumps scattered throughout the Province, typical of those depicted in Figures 5, 6, 7, and 8.

4.2 Physical:

In general the soils of the Province are not deep and provide, on the average, approximately ten feet of soil over fractured sandstone bedrock. Relatively

FIGURE 5
UNSUPERVISED DUMPING

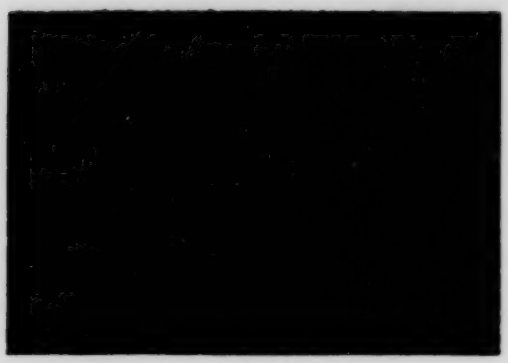


FIGURE 6
OPEN BURNING IN DUMPS

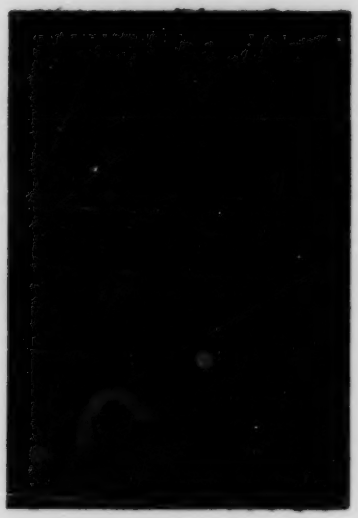


FIGURE 7
PROMISCUOUS DUMPING
DUE TO SEASONAL ACCESS

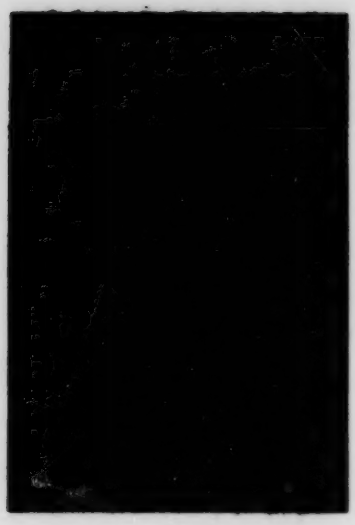


FIGURE 8
PUBLIC ROADS NEAR DUMPS

high water tables are frequently associated with much of the area which permits severe limitations to the choice of a disposal site and its operational alternatives.

4.3 Refuse Disposal:

4.3.1 Dumps

An Opportunity for Youth Province-wide survey conducted during the summer of 1972 revealed that there were approximately 237 sites used for refuse disposal in Prince Edward Island.

Of these, 19% were within 100 ft. of a watercourse; 83% were not accessable year-round; 57% served rural areas with less than 10 houses per mile; 45% were visible from adjacent highways; 93% had no dumping supervision; 35% constituted a fire hazard; and 30% encroached on public highways.

Twenty-three of these sites serve municipalities, while the remainder have been established by rural residents. (1 site for every 263 people) In addition, the common rural practice of backyard burning and dumping at rear of properties have resulted in a large number of "private" dumps throughout the Province.

4.3.2 Rural Practices:

Waste disposal in rural communities has historically been considered a local problem despite the fact that, because of sparse population densities, limited funding and the inability to adequately organize, these areas are least likely to afford proper sanitary disposal.

Disposal of wastes at the rear of the property or at the local dump is normally seasonal chore although the apparent trend is to more frequent disposal off the property.

Cull potatoes, other contaminated crop wastes, animal carcasses and obsolete machinery, once left on the farm are now appearing in local dumping areas, along roadsides, banks of watercourses and in other undesirable areas.

FIGURE 9

Cull potatoes carelessly "dumped" in community disposal sites create pollution and operational problems.

The result is increased population hazards and unsightliness. Animal wastes, especially hog manures although still a valuable fertilizer are becoming problem wastes for storage and disposal because of

increased volumes, obnoxious odors and the competition of easy to handle chemical fertilizers. Land spreading is becoming more "disposal" than "utilization", while increased application rates, in turn, causing increased hazards of stream contamination through run-off.

4.3.3. Municipal Practices:

The City of Charlottetown and the Town of Summerside both process their refuse at conical "Teepee" refuse burner sites. The Summerside "incinerator" is located at St. Eleanors and is owned and operated by a private contractor who relies on contracts with the Town and surrounding communities for operating funds. The Charlottetown incinerator is funded jointly by the area municipalities on a per capita cost sharing basis.

FIGURE 10

Fly ash, and noxious smoke are emitted uncontrolled from "Teepee" burners.

Together, these two operations receive the refuse of the Province's two major population centres approximately 40,000 people and virtually all of the areas wastes. Both incinerators are over-taxed and refuse is often diverted to open burning at the disposal areas. Smoke, fumes, fly ash and other air borne contaminates are allowed to pass freely into the atmosphere and can frequently be viewed from some miles distant.

The remaining 23 municipalities operate open dumps serving approximately 13,000 people. Trenches have been provided at most sites through government assistance and some 16 municipalities have provided attendants to control operations during regular dumping hours and some have achieved a reasonable degree of operational efficiency. However, the majority of sites receive only cursory supervision and a minimum of maintenance. In virtually every instance, exposed putrescible refuse can be found at the sites which attracts rodents, flies, and other vectors.

4.4 Refuse Collection:

Of the thirty-one municipalities, less than a third, have municipal contracts with private collectors for domestic refuse collection on a regular basis. Other municipalities and their rural fringe areas are serviced by local contractors providing refuse pick-up and disposal to local dumps on a "pay as you go" basis. The cost of this service ranges from approximately $.25 to $1 per pick-up. In many cases, individuals transport their own refuse to the dump.

TABLE 4

SOLID WASTE SURVEY OF MUNICIPALITIES ON P.E.I.

MUNICIPALITIES	1971 POPULATION	COLLECTORS	% HOMES SERVICED	COLLECTION COST PER HOUSEHOLD $	MUNICIPALITY $	DISPOSAL COSTS MUNICIPALITY $	TOTAL MUNICIPAL COST $	DUMP SITE
CITY								
Charlottetown	19,133	Superior Sanitation	100		109,000	20,000	129,000	Q-70
TOWNS								
Alberton	973	Vernon Gallant	90	.50/pickup		1,047	1,047	P-2
Borden	624	Edward Larter Sam Walsh	30	.75/pickup		1,000	1,000	*P-64
Georgetown	767	Eugene Jessome William Clory	12	1.00/week		1,678	1,678	K-49
Kensington	1,086	Lionel King Lawrence Silliker	100	.50/pickup		1,312	1,312	P-57
Montague	1,608	Walter LeClair Louis MacHerron	55	2.00/month		2,000	2,000	K-55
Souris	1,393	William Banks Omar Cheverie Earl MacDonald Francis Weir	60	.50/pickup		1,500	1,500	K-7
Summerside	9,349	Jack Wedge	90	3.00/month		16,000	16,000	*P-52
VILLAGES								
Bunbury	527	Barry Munn	100		-----3,048	------	3,048	Q-70
Cardigan	266	N/A				280	280	K-46
Central Bedeque	213	N/A				700	700	P-55
Cornwall	657	Superior Sanitation	100		-----3,624	------	3,624	Q-70
Crapaud	246	Ken MacDougall	100		-----1,300	------	1,300	*Q-18
Kinkora	272	Eddie McCarville						P-67
Miminegash	417	N/A						*P-52
Miscouche	750	Edmond Duroche	80	2.00/month		863	863	K-24
Morell	387	L. Deveaux	90	.50/week				Q-74
Mt.Stewart	413	N/A				500	500	K-67
Murray Harbour	367	N/A				500	500	K-66
Murray River	478	N/A				3,860	3,860	Q-85
North Rustico	767	Andrew Gallant Ernest Buote	33	.75/pickup		1,710	1,710	P-26
O'Leary	795	Cyril Easter	10	.50/pickup	----12,611	------	12,611	Q-70
Parkdale	2,313	Superior Sanitation	100			1,200	1,200	*P-52
St.Eleanors	1,621	Jack Wedge Vernon Gallant	90	2.00/month				
St.Louis	166	N/A						
St.Peters		N/A			-----18,534	------	18,534	Q-70
Sherwood	3,807	Barry Munn	100					
Southport	640					1,080	1,080	P- 2
Tignish	1,060	N/A			540	550	1,090	P-54
Tyne Valley	150	Vaugn Ramsay	100		----- 780	------	780	*Q-18
Victoria	171	Ken MacDougall	100			936	936	P-38
Wellington	347	N/A				935	935	*P-52
Wilmot	737	Jack Wedge	90	2.00/month			TOTAL $206,888	

Estimated Total Household costs: $98,580

* Privately owned disposal sites

NOTE: Data for this Table was taken from a Survey conducted in November 1972.

The contractors serving Charlottetown and Summerside operate modern rear-loading packer trucks of 18 to 25 cu. yds. capacities and employ from 2 to 4 men per vehicle. With the exception of the operator in the Souris area using a packer truck and a collector in the Kensington area using a horse drawn cart, all other collection contractors use trucks ranging in size from 1/2 ton pickups to 10 ton steel box heavy duty vehicles. The type of enclosures range from plywood enclosures to tarpaulins, with the majority of vehicles having no enclosures at all.

With the exception of five contractors operating vehicles serving the Charlottetown, Summerside and Souris areas, all other collectors have other major means of employment and operate single vehicles on a weekend or part-time basis.

A review of many collection routes particularly in rural communities, indicates that collectors service only a portion of households on their routes. Some homeowners are reluctant to pay for the available service in favour of free promiscuous dumping. Municipal officials are reluctant to provide municipal contracts or regulate open burning and refuse storage. These are the major reasons why the present situation exists.

4.5 Government Programs:

4.5.1. Federal:

A variety of Federal "Winter Works" Programs and more recently Local Initiative Programs have looked favourably on the establishment of community disposal facilities. In virtually all cases, however, success

in either receiving funds or establishing a successful disposal site depend on the initiative and capabilities of local people. Present controls and technical assistance has not been sufficient to provide adequate numbers or distribution of sites in terms of residential service requirements or to ensure that such disposal sites, when developed, are in suitable locations with respect to access and maintenance.

4.5.2 Establishment Grants:

In 1966 the Department of Community Services and the Department of Tourism cooperated to provide a measure of direction and financial assistance to "Communities" by providing a $150 Grant for the establishment of community disposal sites. Ironically, however, the effect was to establish more dumps many of which were situated on poor land, on out of the way back roads, and were poorly maintained. This defeats the fundamental principles of efficiency of size and convenience of access and at the same time implies a government responsibility and "authorization" to the practice. Although the terms of the Grant clearly stated that proper operation be provided by the Community, the method of operation was not developed or enforced.

4.5.3 Dump Maintenance:

Prior to 1973, no specific budget allocation was made for disposal site maintenance. The Department of Highways did however provide earth moving equipment, on request, for annual maintenance to most disposal sites established under the Tourism Grant and to those operated by most municipalities. Records indicate that more than 50 sites receive assistance at an estimated cost of approximately $30,000. Service constitutes mainly of burial of accumulated refuse in the spring and fall and in recent years the excavation of trenches for future disposal.

This effort was made to improve access to the sites and to provide some cover for reasons of public health and safety. This service has been increased to the betterment of the disposal sites, but has again tended to establish provincial responsibility.

4.5.4 Potato Burial Program:

The Department of Agriculture provides free service for on-site burial of potato culls in quantities in excess of ten tons. This program has been utilized by a number of growers in 1972 at an approximate cost of $10,000. While the program has been most beneficial to the larger

growers and processors, (grading stations, etc.) and has certainly averted many potential incidents of soil and water contamination, it has not been of particular assistance to small growers. Promiscuous dumping by small growers and otherwise thoughtless individuals continue to be a major pollution hazard including the serious hazard of crop infection and the overloading of community refuse facilities.

4.5.5 Derelict Vehicle Program:

The Department of Community Services has provided the service of "old car body" removal in combination with their unsightly premises responsibility. Old car bodies are removed by the Department at the owners request to one of the 23 "car pits". Seventeen contractors across the Province have been authorized by the Department to solicit owners for permission to remove car bodies. The haulers are paid an average of $8 per hulk for removal to the pit and an additional $3 to $4.50 for stripping in preparation for crushing. Sydney Steel Corp. provides a crusher and transports the hulks to their plant in Sydney, reimbursing the Province at a rate of approximately $7 per hulk.

Although, old automobile bodies are in abundance (over 3,000 visible from the highways) and being added to annually, the result of the 1971-72 program indicated that only 1,052 hulks were removed to the "car pits". This figure represents approximately half of the province's estimated annual generation.

4.5.6 Legislation:

Several Provincial Acts with accompanying regulations and a number of municipal by-laws are in existence which regulate waste disposal methods and prohibiting promiscuous dumping. Frequent apparent overlapping of areas of waste management jurisdiction occur. As a result, in a number of areas, there is a lack of uniform or related programs, and why offenders are often not penalized.

A more detailed review of legislation than has been carried out for the purposes of this Report will be required to provide pertinent and specific recommendations. However, it is apparent that a review and consolidation of existing legislation is required. This consolidation should be developed to reflect governments policy by clearly specifying waste management responsibilities, by requiring the most acceptable management practices which can be practically attained and by providing the necessary means for enforcement.

CHAPTER 5

5. PROPOSED SOLUTIONS:

5.1 General:

The concept that "the polluter must pay" or more appropriately that "the generator must be responsible for his own wastes" must be accepted as a basis for a solution to the Province's waste management problems.

The first category wastes as described in Section 3.3 are primarily generated by people in their normal daily functions and can logically be considered as a "public" or "municipal" responsibility. The second category of wastes are primarily generated by business or industry as a by-product of production and can as logically be considered a "private" or "corporate" responsibility.

This Chapter deals with the development of a management system for the first category of wastes, previously identified as the Province's major problem.

5.2 Standards and Objectives:

5.2.1 General:

A uniform minimum standard of waste handling and disposal must be established and enforced throughout the Province. Differences in population density and the components of waste must be considered in the selection of methods, however, the selection must result in the maintenance of an adequate standard in terms of:

(1) Pollution control, including public

health nuisance and esthetics and,
(2) Convenient service to users which will ensure acceptance of the system and its eventual success.

5.2.2 Storage:
In general, materials must be stored in such a way as to ensure against pollution, spread of disease and nuisance. Putrescible wastes should be stored for a short time as is practical, which should not exceed one week. Containers must have tight fitting lids and be designed for easy and safe handling.

5.2.3 Collection:
Where domestic refuse collection is provided, a basic service should provide a minimum of once-weekly curb-side collection. Such collection should allow for an average of 50 lbs. per household per week, with special collecting being provided for spring cleanup, christmas trees, etc., to ensure systematic removal of all normal household and municipal wastes. Refrigerators, furniture and other bulk waste may be handled by special contractual arrangement as spring cleanup. However, the efficiency of the basic collection service should not be jeopardized by these items.

Commercial, institutional and business wastes, etc., should not be included in the basic domestic system. Separate contractural arrangements should

be made for these wastes or self-haul provided by the establishment as an establishment responsibility.

Collection vehicles must be provided with adequate means and properly operated so as to maintain refuse within the vehicle. Vehicles and workman must be maintained in a clean sanitary condition at all times.

5.2.4 Disposal:

Unauthorized or promiscuous disposal of any waste should be prohibited. Where on-site disposal is considered practical, consideration must be given to the effects of such disposal regarding potential soil, groundwater, or surface water pollution and esthetic detriment.

In rural areas and smaller communities an adequate "disposal" site should be provided within a maximum of five highway miles, from 90% of any resident. Sites may provide either final disposal, i.e. local landfills, or temporary disposal, i.e. containers for later removal to central disposal sites. Sites must provide for convenient safe "disposal" and be accessible to the public during no less than two days a week for an accumulative total of not less than twelve hours per week. With the exception of sites utilizing containers, sites should be supervised during public dumping periods.

All disposal operations, including landfill operations and the various volume reduction processes must be made subject to the responsible government agency.

5.2.5 Incineration:

No open burning of any refuse whatsoever should be permitted without having the specific authorization of the responsible provincial agency.

In many instances, on-site incineration or burning of certain forms of waste may be practical. For example, the practice of back-yard burning in rural areas where residential units do not exceed one dwelling per two acres, or eight units per mile of highway may be considered acceptable where no objectionable smoke or fumes result to impair the quality of life of other residents. In these cases, homeowners should be required to provide themselves with an adequate container elevated to allow sufficient air for combustion and fitted with a spark screen to prevent fire. This practice should not be permitted in areas where the above mentioned housing density is exceeded.

The practice of incineration of municipal and general refuse by a municipality or by a private person, company, etc. can not be permitted unless adequate emission control devices are installed to ensure the maintenance of air quality objectives. All such operations must be subject to the approval

of the responsible government agency.

5.2.6 Landfill:

All operations involving the burial of putrescible refuse must maintain the standards of sanitary landfill methods. Briefly, refuse must be compacted and receive a minimum of six inches of earth cover at the completion of each days operation, and a final cover of two feet upon site completion. All landfill operations must meet the approval of the responsible agency.

5.2.7 Disposal Site Selection:

In considering the location and operation of refuse disposal sites, the responsible agency must maintain the following objectives:

(1) To avoid jeopardy to public health and safety including ground and surface water pollution, degradation of the air quality (production of gas, noise, odors, dust, smoke, etc.).

(2) To be acceptable to the public including isolation from sight and providing convenient all weather access.

(3) To be compatible with planning and development of the area including future land use.

(4) To be capable of proper development, operation and finishing at an equitable cost to all people served.

5.3 Waste Management Responsibility:

Development and analysis of an equitable waste management system for the Province as a whole can not be effectively carried out or implemented unless the following division of responsibilities are made.

(a) The central Provincial Government is responsible to ensure that a system of convenient refuse disposal is effected. Such a system must be adequate to maintain a pollution free environment and to protect public health and safety.

(b) Municipalities must be made responsible for providing disposal of municipal, domestic, commercial and institutional wastes which are generated within their boundaries.

(c) "Municipalities" means -

(1) Any incorporated Village, Town, City and Community Improvement Association.

(2) In the case of rural un-incorporated P.E.I. the Provincial Government in lieu of County Government will be deemed the responsible municipal agency.

(d) All refuse disposal operations including the functions of collection, transportation, transfer, processing, storage and final disposal must meet the standards and requirements of operation as set forth by the Environmental Control Commission.

5.4 Waste Management Systems:

5.4.1 General:

A waste management system is considered to be composed of three basic components: collection, transportation, and disposal. Together they fulfill the objectives of the total waste management system. By following the flow lines in Figure 11, one can appreciate that there are a number of different ways of arriving at a desired solution. The most feasible methods will be proposed and analyzed in following Sections. However, there are some impractical functions which, at first glance, appear feasible but after careful consideration can not be economically justified.

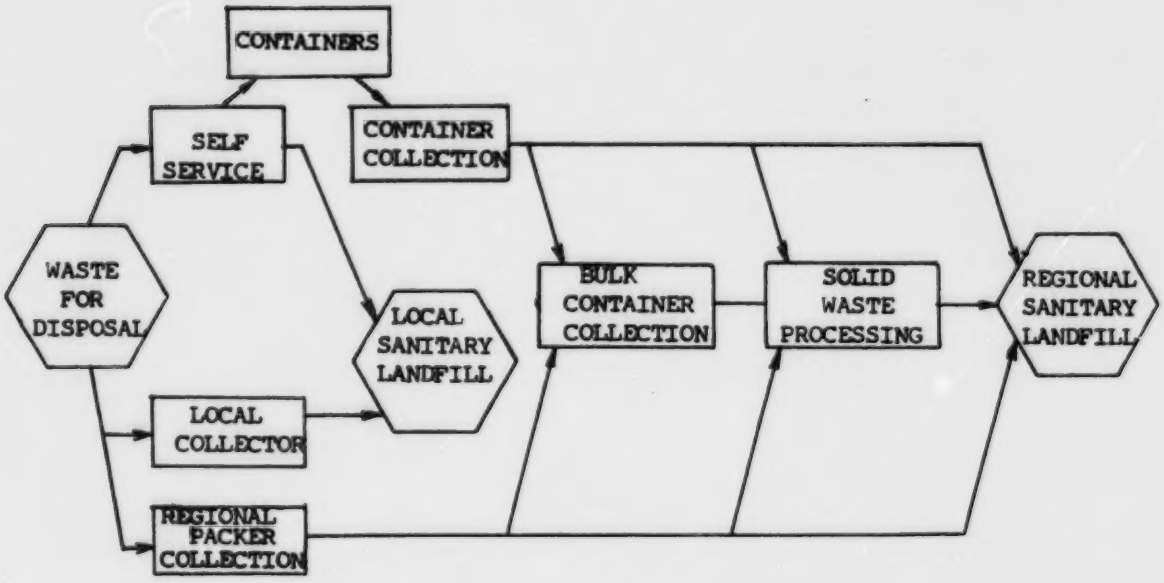


FIGURE 11

SCHEMATIC DIAGRAM OF SYSTEM ALTERNATIVES

5.4.2 Waste Processing Alternatives:

Waste processing, including volume reduction and salvage, are only considered when, for reasons of economy or reduction of pollution potential, their introduction is justified. Most forms of processing and material recovery require a combination of large refuse volumes and a dependable market before the expensive processing and handling equipment can be justified. Figure 12 indicates a combination of process functions are often self supporting, but which at the same time, are interdependent and vulnerable to changes in refuse composition, operation and marketing costs.

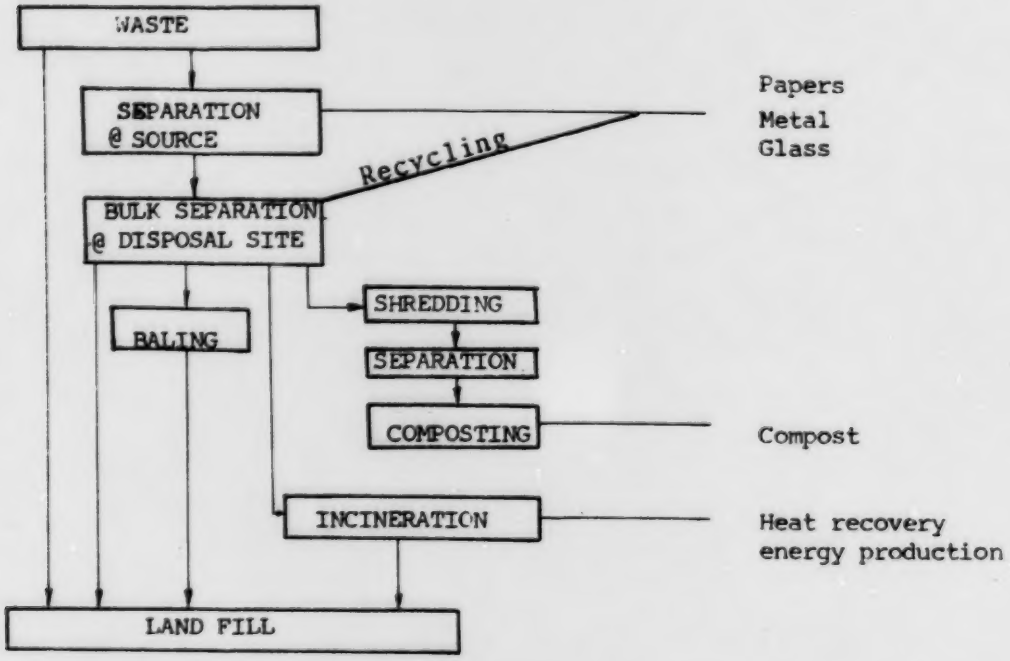


FIGURE 12
PROCESSING ALTERNATIVES

Correspondence with a major supplier of processing systems revealed that a population of approximately four times that of P.E.I. would be required to justify such a system. Figure 13 presents a tabulation of comparative capital and operating costs of system components.

	Average Capital ($/T)	Average Operations ($/T)	Average Total ($/T)
Process functions:			
Manual Separation			5.00*
Shredding			2.00**
Mechanical Separation			6.00***
Processes:			
Thermal Incineration	7.05	4.35	11.40
Heat Recovery Incineration	9.06	3.88	12.94
Hydrapulping	11.58	8.94	20.52
Composting	4.03	8.68	12.71
Pyrolysis	16.94	9.10	26.04
Landfill	.45	2.70	3.25

* $5.00 Solid Waste Processing, A State of the Art - Page 52

** $2.00 Solid Waste Processing, A State of the Art - Page 12

*** $6.00 Industrial Possibility of Solid Waste Reclamation in the Saint John Area, Bachelor of Civil Engineering Report U.N.B. 1971.

FIGURE 13

COMPARATIVE COSTS OF SYSTEM COMPONENTS (50,000 T/Y)

Composting:

This process requires a preselection or sorting process where approximately 65% of normal municipal refuse undergoes an aerobic bio-degradation process which yields a stable organic humus-like material. Used either in its basic form or with added nutrients, humus is a valuable soil conditioner. Although virtually all composting projects in North America and Europe have proven uneconomical, research is being conducted with material, selective "landfill techniques".

Incineration:

Incineration is not a complete disposal method, but rather a means of reducing the volume of solid waste. Approximately 70% to 80% of normal municipal refuse is considered to be incinerable. The remaining refuse including incinerator ash must then be disposed of in a sanitary landfill. While incineration is more costly than sanitary landfill, these costs may be offset by the more centralized location of the incinerator resulting in reduced refuse transportation costs. On the other hand, noise, truck traffic and the general awareness of the close proximity of the incinerator to residential areas are some of the problems in finding a suitable site location.

Serious consideration was given to incineration for the Province's wastes, however, the factors required to justify an economical incineration of present design are not favourable.

The volume of waste generated in the Province provides a marginal feasibility for operation, however, prohibitive refuse transportation costs to the site would be incurred. Table 13 has further indicated the relatively high cost of capital and operating expenses of incineration when compared with the costs of an alternative sanitary landfill.

5.4.3 Reuse and Recycling:

Although extensive experimentation is currently being carried out by industry and government in this field, only a limited variety of materials can be recycled economically at this time. Collection, sorting, processing and transportation costs place most used materials at a disadvantage as compared to new manufacture.

Metals:

Of the more common materials currently being reclaimed: (Glass, metals, paper and textiles), only certain metals appear to have the necessary economic feasibility to support a commercial venture in the foreseeable future. These materials are presently being exported by salvage companies.

Glass:

Approximately 5% of normal solid waste or 3,000 tons per year is composed of glass containers and miscellaneous glass. The nearest market is Scoudouc, N.B. where sorted clean glass is valued at $20 per ton. Shipping, collection, sorting and storage costs are estimated to be $45 per ton*

* From recent report of O'Brien Iron & Metal Co. Ltd.

resulting in a net loss of $25 per ton. Moreover, the plants requirements can be filled from the Moncton area.

Paper:

While up to 55% or 34,000 tons of the Province's annual solid wastes are of paper materials, only a relatively small percentage, in the form of corregated cartons, newsprint, magazines, etc. are of the "clean" quality suitable for recycling. High quality baled paper is valued at $25 per ton at the Minas Basin Pulp operation, Hantsport, N.S. (which is the only plant in the Maritimes having the capability of utilizing paper). Again, transportation cost of $15 per ton does not allow sufficient margin for collection, sorting, and baling to make this a profitable venture.

5.4.4 Disposal Alternatives:

There are basically only two options available for final disposal of refuse: Landfill or ocean dumping. Obviously, the latter is unsatisfactory in this geographic area and it is questionable if future pre-disposal processes will be developed to allow for safe economical ocean disposal for normal refuse. Consequently, in terms of this Study, only sanitary landfill will be considered as an acceptable method of final disposal.

Sanitary Landfill:

As defined by the American Society of Civil Engineers, a Sanitary Landfill is, "A method of disposing of refuse in land without creating nuisance or hazard to public

health or safety, by utilizing the principles of engineering to confine the refuse to the smallest practical area, and to cover it with a layer of earth at the conclusion of each day's operation, or at such more frequent intervals as may be necessary".

A pictorial presentation of sanitary landfill methods are presented in Figure 14.

5.5 System Development & Analysis:

Two complementary methods were used to develop and analyze feasible alternate management systems of waste handling which would provide the best and least costly system to the Province as a whole.

The first method consisted of developing a Province-wide transportation-disposal cost evaluation to indicate the approximate location and number of the disposal sites which would provide the least cost combination of haul and disposal for the Province for a period of not less than 10 years.

The second method involved the application of the results of the first analysis in the development of typical disposal systems, including collection (where applicable), haul and disposal which would fulfill the requirements of:

(1) "Standards and objectives" as set forth in preceding sections, and,
(2) The municipal responsibilities as outlined in the preceding Section.

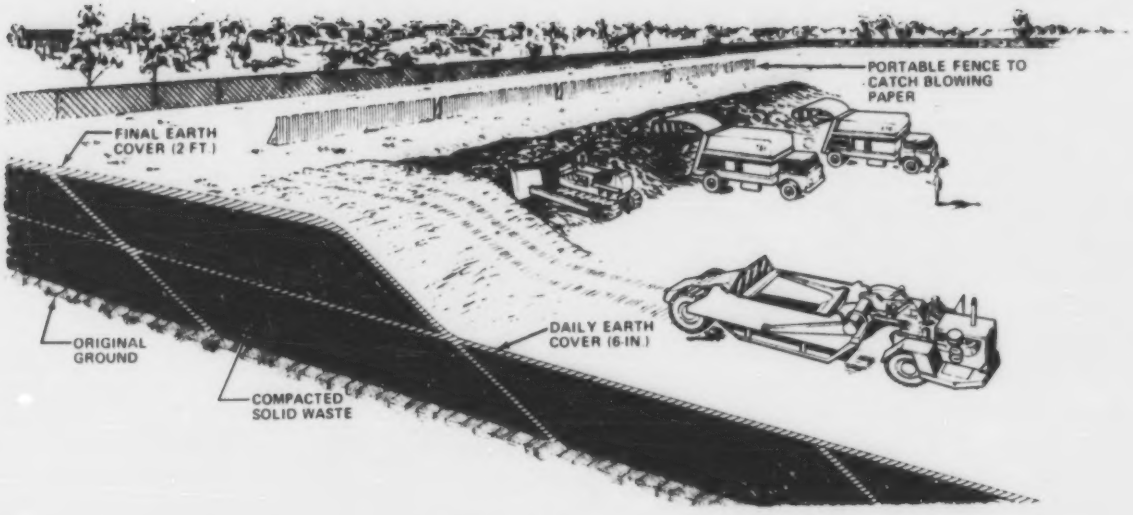

PORTABLE FENCE TO CATCH BLOWING PAPER
FINAL EARTH COVER (2 FT.)
DAILY EARTH COVER (6 IN.)
ORIGINAL GROUND
COMPACTED SOLID WASTE

FIGURE 14A

AREA METHOD. The bulldozer spreads and compacts solid wastes. The scraper (foreground) is used to haul the cover material at the end of the day's operations. Note the portable fence that catches any blowing debris. This is used with any landfill method.

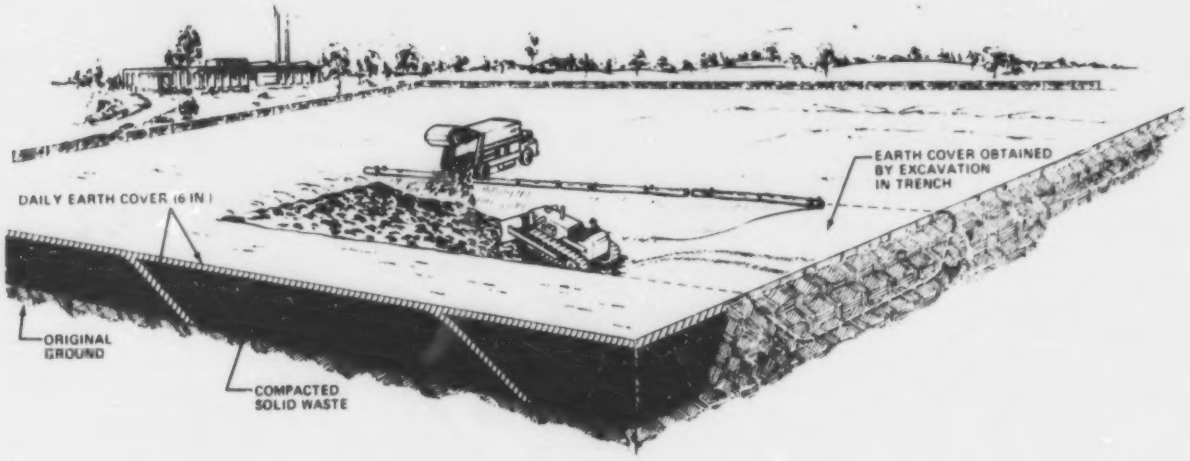


FIGURE 14B

TRENCH METHOD. The waste collection truck deposits its load into the trench where the bulldozer spreads and compacts it. At the end of the day the dragline excavates soil from the future trench; this soil is used as the daily cover material. Trenches can also be excavated with a front-end loader, bulldozer, or scraper.

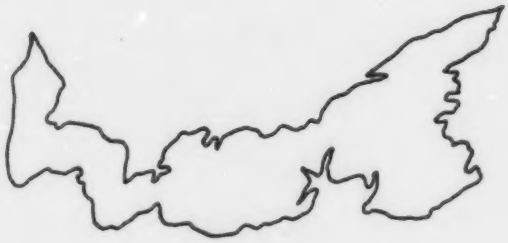
5.5.1 Province-wide Haul - Disposal Analysis:
Refuse generation and distribution was approximated by combining the estimated per capita generation rate with the population figures for 67 generation areas, plus Charlottetown and Summerside. Refuse disposal sites were selected and their operating costs were established for a range of refuse quantities. Refuse transportation costs were determined for hauling the refuse from the centre of the generation areas to each of the alternate disposal sites.

5.5.1.1 Refuse Regions:
To facilitiate the haul-disposal analysis, several schemes were developed dividing the Province into a number of regions, (See Figure 15) having alternate potential disposal sites, as follows:

Scheme (1) Total Province - 3 alternate sites
Scheme (2) Two regions - 3 alternate sites
Scheme (3) Three regions - 3 alternate sites
Scheme (4) Four regions - 4 alternate sites
Scheme (5) Six regions - 3 alternate sites
Scheme (6) Two regicnal - incineration sites

By selectively combining regions a large number of potential management alternates were available for haul-disposal analysis.

5.5.1.2 Refuse Quantities:
To simplify the analysis process a uniform rate of two lbs. per person per day of domestic and commercial refuse was distributed via population



SCHEME 1
ONE REGIONAL SITE

SCHEME 2
TWO REGIONAL SITES

SCHEME 3
THREE REGIONAL SITES

SCHEME 4
FOUR REGIONAL SITES

SCHEME 5
SIX REGIONAL SITES

SCHEME 6
TWO REGIONAL-INCINERATION SITES

FIGURE 15
REFUSE REGIONS

figures for all areas except Charlottetown and Summerside which were assigned a generation rate of 3.4 lbs. per person per day. Current population data with projections to 1991 were provided by the Department of Development and is presented in Table 1.

Institutional and tourist refuse quantities were developed and added to the domestic and commercial quantities providing an estimate of total refuse for each generation area for the base year of 1971.

An increased generation rate of 7% in each 5 year increment was considered suitable for this Province. This generation rate was then combined with the projected increase population data to provide estimated annual refuse generated to 1991 as presented in Table 2.

5.5.1.3 Site Selection:

An analysis of site selection criteria, (physiographic characteristics pertinent to disposal site operation) depth of soil, depth to water table, distance to paved highways, etc.) revealed that considerable on-site investigation would be required to determine site factors which would significantly influence site operation cost.

Therefore, an "average condition" was assumed for all site costing.

Preliminary selection identified some 200 potential sites which were later reduced by photo interpretation to a number of sites required for analysis.

5.5.1.4 Site Operation:

"Average" site capacities and operating costs were developed based on the following criteria:

- maximum depth of trench to be six feet;
- two area lifts permitted, each of approximately eight feet in height.
- on-site material was considered suitable for cover.

A series of "average" site development operating financing costs were developed as presented in Table 5 for a range of refuse quantities predicted for the generation areas.

5.5.1.5 Refuse Haul:

Charlottetown and Summerside refuse was assumed to be collected and hauled to the disposal site by the collection vehicles, with a two-man crew, with a calculated haul cost of 14.7¢ per ton/mile, as developed in Table 6.

Refuse from all other areas was assumed to be transferred to 40 cu.yd. roll-off containers with a calculated haul cost of 8.7¢ per ton/mile as developed in Table 6.

The figures of 14.7¢ for Charlottetown and Summerside was felt to be somewhat higher than the actual cost situation, where some commercial and institutional, etc., wastes could be hauled by less expensive bulk container equipment. However, the difference would compensate for seasonal fluctuations and for refuse in excess of 2.4 lbs. per capita per day in areas adjacent to Charlottetown and Summerside.

Highway distance was measured from centroids of generation areas to each potential disposal site.

The ton/mile haul rates were applied to the generation quantities and measured distances to the selected potential disposal sites. The resulting "haul costs" were combined with the site disposal costs for each scheme (series of regional divisions), yielding a total haul plus disposal "cost", as presented in Table 7.

It should be noted that while the disposal figures are representative of total actual cost, haul figures were estimated considering factors relative to distance hauled (as required to fulfill the objectives of this analysis), but did not include certain cost factors such as loading-unloading which were not relative to distance.

5.5.1.6 Analysis Results:

The results of the analysis, as summarized in Figure 16 indicates that the least cost combination of refuse haul and refuse disposal can be accomplished by Scheme Two: i.e. by operating two disposal sites and by transporting the Province's wastes to either of these sites. The addition of one other disposal site (Scheme 3) increases the relative haul-disposal costs by 4%, while the addition of two disposal sites (Scheme 4) increases the cost by only 3%. (For further information, see Table 7).

SCHEME	NUMBER OF DISPOSAL SITES	TOTAL HAUL DISPOSAL COSTS	RELATIVE COST INCREASE (Based on Scheme 2)
		$/T	%
1	single site	10.00	+22%
2	2 sites	8.16	0%
2a	2 incinerator sites	19.58	+139%
3	3 sites	8.54	+ 4%
4	4 sites	8.42	+ 3%
5	6 sites	9.32	+14%

FIGURE 16

SUMMARY OF COMPUTERIZED HAUL DISPOSAL COSTS

Incineration operation emerges as the highest cost alternative, some 139% greater than Scheme Two, and will therefore not be considered in further analysis.

Considering the assumptions made necessary in conducting this analysis, the cost similarity of Schemes 2, 3 and 4 is not considered adequate to clearly indicate a preference on cost factors alone. Transportation factors such as variable road and traffic conditions; and waste quantity factors such as seasonal generation fluctuations indicates a preference to the operation of the more versatile four disposal site system. Scheme 4 is therefore selected as the most desirable haul-disposal alternative and will be further developed as the basis for the waste management system analysis developed in the following section.

5.5.2 Province-wide Management System Analysis:

Three basic alternate systems were designed and developed as follows:

System A:
A system of local sanitary landfill sites providing refuse disposal for all domestic, commercial and institutional wastes within five miles of 90% of the Province's residents.

System B:
Weekly curb-side collection for all households and twice weekly container collection for all commercial, institutional, etc., wastes; for disposal at regional sanitary landfill sites.

System C:
Container refuse transfer sites for local domestic, commercial and institutional refuse within five miles of 90% of the Province's residents with disposal at jointly operated sanitary landfill sites.

5.5.2.1 System A:
A system of local sanitary landfill sites providing refuse disposal for all domestic, commercial and institutional wastes within five miles of 90% of the Province's residents.

- Sites will accommodate domestic bulk items, such as: stoves, fridges, furniture, etc.

Sites will be open for supervised public dumping for at least two days per week for an aggregate of not less than twelve hours per week.

It was assumed that the sites serving the larger

municipalities of Charlottetown and Summerside would also serve their respective adjacent municipalities. An additional 23 sites would be required to service the remaining municipalities with approximately 30 sites to serve the remaining rural areas. Figure 17 indicates pattern of disposal site location.

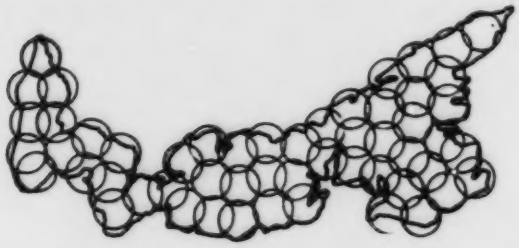


FIGURE 17
DISTRIBUTION OF LOCAL DISPOSAL SITES

Weekly curb-side collection for all households and twice-weekly container collection for all commercial and institutional wastes were considered necessary in the Charlottetown and area, and the Summerside and area municipalities, and were therefore included in the cost estimates.

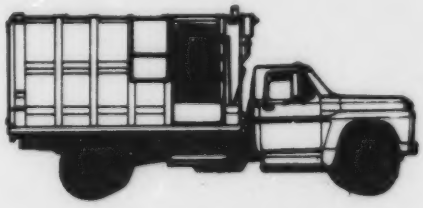


FIGURE 18
Typical side loading packer vehicle for domestic collection service.

Because of the convenience of location of all other disposal sites for self service, collection was considered a municipal or individual option rather than a necessity and was therefore not included in the cost analysis.

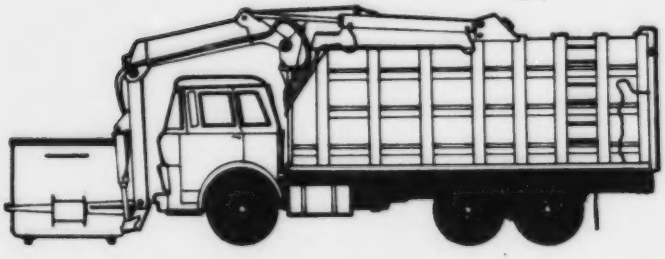


FIGURE 19

Typical front end loading packer vehicle for commercial and institutional container refuse collection

Smaller sites will be systematically serviced by transferring the necessary equipment to the sites as required to meet sanitary landfill criteria.

TABLE 14

COST DEVELOPMENT - SYSTEM A

REGION	REFUSE QUANTITIES T/Year[a] (Table 8)	COLLECTION containers $/Year[a] (Table 11)	COLLECTION collection $/Year[a] (Tables 10&11)	HAUL $/Year[c]	DISPOSAL $/Year[b]	TOTAL ANNUAL COSTS $/Year	TOTAL ANNUAL COSTS $/Ton
Ch'Town & Area							
Domestic	7,524		107,411	15,484		122,895	16.33
Commercial +	19,679	75,000	117,030	27,550		219,580	11.16
Municipal	400				105,180	105,180	3.81
	27,600						
S'Side & Area							
Domestic	3,273		50,427	6,736		57,163	17.47
Commercial	5,770	22,000	37,752	8,078		67,830	11.76
Municipal	200				51,350	51,350	5.55
	9,240						
Rural Municipal (23 sites)	10,902 (474)[d]				385,520 (16,760)[d]	385,520	35.36
Rural (30 sites)	15,017 (500)[d]				510,000 (17,000)[d]	510,000	33.96
Totals	62,748	97,000	312,620	57,848	1,052,050	1,519,518	24.21
Percent of Total System Cost		6.4%	20.6%	3.8%	69.2%	100%	(Average $/T for total system)

a. Figures presented in this column were developed in the tables as indicated.
b. Figures presented in this column were developed by "straight line" interpolation, from total annual disposal site costs developed in Table 5.
c. A return haul distance of 14 miles was used in combination with haul rates developed in Table 6.
d. Figures in brackets are average for number of sites.

5.5.2.2 System B:

This provides Province-wide weekly curb-side collection for all household and twice weekly container collection for all commercial, institutional, etc., wastes; with disposal at regional sanitary landfill sites.

An optimum number of four regional sanitary landfill sites will be operated providing the most desirable combination of refuse haul plus disposal costs to the provincial system.

Regional disposal sites will be operated 8 hours a day, 6 days per week for supervised disposal of collected refuse.

This system does not provide for collection of bulk items such as stoves, fridges, furniture, etc.

Two sites, in addition to the four regional sanitary landfill sites, will be established for disposal of bulk wastes. These sites will be open approximately two days per month or by arrangement for supervised disposal. Homeowners, etc. will be responsible for removal and disposal of bulk items to either the special bulk waste sites or a regional site.

TABLE 15

COST DEVELOPMENT - SYSTEM B

	REFUSE QUANTITIES	COLLECTION			HAUL	DISPOSAL	TOTAL ANNUAL COSTS	
		containers	sites	collection				
	T/Year[a]	$/Year[a]	$/Year[a]	$/Year[a]	$/Year[a]	$/Year[b]	$/Year	$/Ton
	(Table 8)	(Table 11)	(Tables 10&11)		(Table 15A)			
Ch'town & Area								
Domestic	7,524			107,411	21,000		128,411	17.06
Commercial	19,679	75,000		117,030	37,390		229,420	11.66
Municipal	400							
S'Side & Area							59,577	18.19
Domestic	3,275			50,427	9,150		70,715	12.25
Commercial	5,770	22,000		37,752	10,963			
Municipal	200							
Rural Municipal							95,144	22.35
Domestic	4,257			72,616	22,528		105,550	15.88
Commercial	6,645	25,000		56,628	23,922			
Rural							547,374	36.45
Domestic	15,017			477,094	70,280			

NOTE: Refuse quantities generated within the four regions are allocated to the respective regional disposal sites for development of disposal costs.

Regional Site (1)	5,582					47,200	47,200	8.46
Regional Site (2)	17,176					72,600	72,600	4.23
Regional Site (3)	36,021					127,000	127,000	3.53
Regional Site (4)	3,760					45,200	45,200	12.03
Bulk Disposal	2 sites					10,060	10,060	
Totals		122,000		918,958	195,233	302,060	1,538,251	24.51
Percent of total cost		8.0%		59.7%	12.7%	19.6%	100%	(Average $/T for total system)

a. Figures presented in this column were developed in the Table indicated.
b. Figures presented in this column were developed by "straight line" interpolation from total annual disposal site costs developed in Table 5.

TABLE 15A

SYSTEM B - HAUL COSTS

REGION	REFUSE QUANTITIES	HAUL DIST. RETURN	HAUL RATE	HAUL COSTS TOTAL	HAUL COSTS RATE
	T/Y	Miles	¢/T-Mile	$/Y	$/T
Ch'Town & Area					
Domestic	7,524	19[a]	14.7	21,000	2.80
Commercial	19,679	19[a]	10	37,390	1.90
S'Side & Area					
Domestic	3,275	19[a]	14.7	9,150	2.80
Commercial	5,771	19[a]	10	10,965	1.90
Rural Municipal					
Domestic	4,257	36[b]	14.7	22,528	5.30
Commercial	6,645	36[b]	10	23,922	3.60
Rural					
Domestic	15,017	36[b]	13	70,280	4.68

a. Return haul distance of 19 miles represents actual haul distance from the municipalities to their selected regional sites. This figure was combined with haul rates developed in Table 6.

b. Return haul distance of 36 miles represents the calculated average haul distance from the rural municipalities to their selected regional sites. This figure was combined with haul rates developed in Table 6.

5.5.2.3 System C:

A system of refuse container transfer sites for local domestic, commercial and institutional refuse within five miles of 90% of the province's residents with disposal at regional sanitary landfill sites.

Weekly curb-side collection for all households and twice weekly container collection for all commercial and institutional wastes was considered necessary in the Charlottetown and area, and Summerside and area municipalities and was included in the cost estimate. It was also assumed that this collected refuse would be hauled directly to the regional disposal sites by the collection vehicles.

Collection was considered a municipal or individual option rather than a necessity for all other areas, and was therefore not included in the cost estimates.

FIGURE 20
Bulk container transfer sites are designed to provide easy access to refuse containers.

Twenty-three bulk container transfer sites will be required to accommodate the remaining incorporated municipalities with approximately 30 additional sites

required to provide service for the remaining rural areas.

Container transfer sites will be provided with a minimum of one 40 cu.yd. container at all times for public convenience. Additional containers, as required, will be provided twice weekly for "disposal days". Sites will receive maintenance and cleanup on the average of one hour per day provided by a mobile maintenance crew serving a number of sites.

An optimum number of four regional sanitary landfill sites will be maintained providing the most desirable combination of refuse haul and disposal costs to the overall provincial system.

FIGURE 21
Bulk refuse containers are transported by special hoist equipment vehicles.

While some bulk items such as stoves, fridges and furniture may be accommodated by the containers, householders will normally be responsible for disposal of these bulk items at either one of the four regional disposal sites or two additional sites to be established for bulk waste disposal. Bulk waste disposal sites will be open approximately two days per month, or by arrangement, for supervised disposal.

TABLE 16

COST DEVELOPMENT - SYSTEM C

	REFUSE QUANTITIES	COLLECTION			HAUL	DISPOSAL	TOTAL ANNUAL COST	
		containers	sites	collection				
	T/Year[a]	$/Year	$/Year[a]	$/Year[a]	$/Year[a]	$/Year[b]	$/Year	$/Ton
	Table 8		12	10&11	6			
Ch'town & Area								
Domestic	7,524			107,411	21,000		128,411	17.06
Commercial	19,679	75,000[c]		117,030	37,390		229,420	11.66
Municipal	400							
S'Side & Area								
Domestic	3,275			50,427	9,150		59,577	18.19
Commercial	5,770	22,000[c]		37,752	10,963		70,715	12.25
Municipal	200							
Rural Municipal (23 sites)	10,902	34,544[d]	141,000		71,884		247,428	22.70
Rural (30 sites)	15,017	46,736[d]	184,000		95,846		326,582	21.75

NOTE: Refuse quantities generated within the four regions are allocated to the respective regional disposal sites for development of disposal costs.

Regional Site (1)	5,582					47,200	47,200	8.46
Regional Site (2)	17,176					72,600	72,600	4.23
Regional site (3)	36,021					127,000	127,000	3.53
Regional Site (4)	3,760					45,200	45,200	12.03
Bulk Disposal	2 sites					10,060	10,060	
Totals		$178,280	$325,000	$312,620	$246,233	$302,060	$1,364,193	21.74
Percent of total costs		13.2%	23.8%	22.9%	18.0%	22.1%	100%	(Average $/T for total syster

a. Figures presented in this column were developed in the Tables as indicated.
b. Figures presented in this column were developed by 'straight line' interpolation from total annual disposal site costs developed in Table 5.
c. Figure developed in Table 11.
d. Figure developed in Table 13.

5.5.2.4. Analysis Results

The results of the analysis of Systems A, B, and C are summarized below:

SUMMARY OF SYSTEM ANALYSIS

	COLLECTION	CONTAINERS	TRANSPORT	DISPOSAL	TOTAL	$/TON
A.	312,620	97,000	57,848	1,052,050	$1,519,518	24.21
B.	918,958	122,000	195,233	302,060	$1,538,251	24.51
C.	312,620	503,280	246,233	302,060	$1,364,193	21.74

The cost of operating local sanitary landfill sites (System A) estimated at $1,052,050 is considerably more expensive than the cost of disposal by regional sanitary landfill, estimated at $302,000 (Systems B and C). However, operation of regional sites require refuse collection or refuse container sites, together with refuse haul, to accomplish the same net waste management. The resulting total system costs therefore are not as significantly different.

The cost of regional disposal site operation as estimated for Systems B and C (Tables 15 and 16) is seen to vary between the regions in relation to refuse quantities. The combined cost of these operations was found (Section 5.5.1.6) to be preferable for province-wide disposal.

The estimated cost of refuse collection for Charlottetown and Summerside areas is a constant factor throughout the analysis of Systems A, B and C and therefore do not contribute to variations in total system costs.

Depending on the life expectancy of the existing Charlottetown dump and the location of a new waste disposal site, Charlottetown is the only municipal area with populations or generations large enough to effect a less than "average" cost. A more detailed site study is required to refine costs, suitability of existing site, and the availability of land for a new site. If such a study confirms the cost differential, consideration should be given to equalizing Charlottetown area costs rather than create an additional site.

Domestic and commercial refuse collection in combination with regional site disposal is seen to be a more desirable management system for rural municipalities than either the operation of local disposal sites or local bulk refuse container systems.

The analysis further indicates that refuse disposal service to rural areas should be provided by local bulk container transfer sites in conjunction with regional disposal sites. While this method will not provide the same degree of service as collection, it is considered the only practical method.

5.5.3 Recommended System:

The analysis of the province-wide system of Section 5.5.1 and the component methods developed in Section 5.5.2 have indicated that:

1. A province-wide disposal system utilizing four regional sanitary landfill sites provides the most preferable management system when operated in conjunction with,
2. weekly curb-side collection for household waste and twice-weekly container collection for all commercial, institutional, etc., wastes generated within incorporated municipalities.
3. a system of bulk container refuse transfer sites for local domestic refuse, located so as to provide "disposal" within five miles of 90% of the Province's remaining rural residents. Approximately thirty such container sites will be required.

The four regional sanitary landfill sites will be operated eight hours a day, six days a week for supervised disposal of collected refuse.

Container transfer sites will be provided with a minimum of one 40 cu.yd. container at all times for public convenience. Additional containers as required will be provided twice weekly for "disposal days". Sites will receive daily maintenance and clean up by a mobile maintenance crew serving a number of sites.

This system does not provide for the collection or disposal of bulk items.

Two sites, in addition to the four regional sanitary landfill sites, will be established for disposal of bulk wastes. These sites will be open approximately two days per month, or by arrangement, for supervised disposal. Homeowners, etc. will be responsible for removal and disposal of bulk items to either the special bulk waste sites or a regional site.

TABLE 17

COST DEVELOPMENT - RECOMMENDED SYSTEM

	REFUSE QUANTITIES	COLLECTION			HAUL	DISPOSAL	TOTAL ANNUAL COSTS	
		containers	sites	collection				
	T/Year[a]	$/Year[a]		$/Year[a]	$/Year[a]	$/Year[b]	$/Year	$/Ton
	(Table 8)	(Tbl. 11&13)		(Tbl. 12)	(Tbl.10&11)	(Tbl. 6&13)		
Ch'town & Area								
Domestic	7,524			107,411	21,000		128,411	17.06
Commercial	19,679	75,000		117,030	37,390		229,420	11.66
Municipal	400							
S'Side & Area							59,577	18.19
Domestic	3,275			50,427	9,150		70,715	12.25
Commercial	5,770	22,000		37,752	10,963			
Municipal	200							
Rural Municipal							95,144	22.35
Domestic	4,257			72,616	22,528		105,550	15.88
Commercial	6,645	25,000		56,628	23,922			
Rural (30 sites)	15,017	46,736	184,000		95,846		326,582	21.75
Regional Site (1)	5,582					47,200	47,200	8.46
Regional Site (2)	17,176					72,600	72,600	4.23
Regional Site (3)	36,021					127,000	127,000	3.53
Regional Site (4)	3,760					45,200	45,200	12.03
Bulk Disposal	2 sites					10,060	10,060	
Total		$168,736	$184,000	$441,864	$220,799	$302060	$1,317,459	21.00
Percent of total cost		12.8%	14.0%	33.5%	16.7%	23.0%	100%	(Average $/T for total system)

NOTE: Refuse quantities generated within the four regions are allocated to the respective regional disposal sites for the development of disposal costs.

a. Figures presented in this column were developed in the tables as indicated.
b. Figures presented in this column were developed by "straight line" interpolation, from total annual disposal site costs developed in Table 5.

APPENDIX OF TABLES

TABLE 1

POPULATION PROJECTIONS OF P.E.I. 1971 - 1991

LOT	COMMUNITY	1971 Rural	1971 Urban	1976 Rural	1976 Urban	1981 Rural	1981 Urban	1986 Rural	1986 Urban	1991 Rural	1991 Urban
Prince											
1	Tignish	1,732	1,060	1,706	1,025	1,680	1,035	1,650	1,042	1,619	1,051
2		1,434		1,450		1,464		1,433		1,444	
	Miminegash		417		427		431		435		438
	St. Louis		166		171		173		175		176
3		679		640		647		608		613	
4		1,114		1,066		1,034		1,000		963	
	Alberton		973		1,024		1,077		1,130		1,139
5		960		939		948		912		919	
6		892		896		905		869		875	
	O'Leary		795		853		905		955		963
7		691		640		604		565		526	
8		690		640		647		608		613	
9		443		470		431		435		395	
10		357		299		302		261		263	
11		599		598		561		565		569	
12		830		811		766		782		744	
	Indian Reserve		201		214		173		218		176
13		711		683		690		652		613	
	Tyne Valley		150		172		173		175		176
14		803		768		733		695		657	

TABLE 1

POPULATION PROJECTIONS OF P.E.I. 1971 - 1991 (Cont'd)

LOT	COMMUNITY	1971 Rural	1971 Urban	1976 Rural	1976 Urban	1981 Rural	1981 Urban	1986 Rural	1986 Urban	1991 Rural	1991 Urban
15		1,653		1,663		1,680		1,693		1,706	
16		643		640		647		652		657	
	Wellington		347		343		345		348		351
17		2,194		2,174		2,153		2,128		2,000	
	Summerside		9,439		9,675		9,859		10,111		10,408
	Miscouche		750		811		862		912		963
	St. Eleanors		1,621		1,876		2,025		2,214		2,276
	Wilmot		737		853		905		1,000		1,095
18		994		981		948		912		875	
19		1,379		1,365		1,378		1,390		1,400	
	Kensington		1,086		1,152		1,207		1,259		1,314
25		862		853		862		825		837	
26		1,050		1,066		1,077		1,042		1,050	
	Central Bedeque		213		214		216		218		220
27		1,153		1,152		1,163		1,172		1,182	
	Kinkora		272		257		259		261		263
28		1,368		1,407		1,421		1,433		1,444	
	Borden		624		640		647		652		657
Sub-total		23,231	18,851	22,907	19,709	22,749	20,292	22,282	21,103	21,964	21,666
Total		42,082		42,616		43,041		43,385		43,630	

TABLE 1 (Cont'd)

POPULATION PROJECTIONS OF P.E.I. 1971 - 1991

LOT	COMMUNITY	1971 Rural	1971 Urban	1976 Rural	1976 Urban	1981 Rural	1981 Urban	1986 Rural	1986 Urban	1991 Rural	1991 Urban
Queens											
20		682		635		654		617		634	
21		783		740		763		729		749	
22		504		530		545		561		576	
23		1,145		1,111		1,144		1,121		1,151	
24		1,359		1,429		1,470		1,513		1,554	
	North Rustico		764		795		818		842		865
29		820		794		817		785		806	
	Crapaud		246		266		274		282		290
	Victoria		171		161		165		176		175
30		609		583		600		561		576	
31		1,375		1,429		1,470		1,513		1,554	
32		1,274		1,323		1,361		1,401		1,439	
	Cornwall		657		742		818		898		980
33		1,534		1,587		1,633		1,681		1,726	
	Royalty		1,418		1,481		1,525		1,569		1,611
	Charlottetown		19,133		19,776		20,406		21,170		21,737
	Parkdale		2,313		2,540		2,668		2,970		3,107
	Sherwood		3,807		4,126		4,246		4,538		4,717
34		1,407		1,481		1,525		1,569		1,611	
35		920		953		980		1,009		1,036	

TABLE 1

POPULATION PROJECTIONS OF P.E.I. 1971 - 1991 (Cont'd)

LOT	COMMUNITY	1971 Rural	1971 Urban	1976 Rural	1976 Urban	1981 Rural	1981 Urban	1986 Rural	1986 Urban	1991 Rural	1991 Urban
36	Indian Reserve	621	109	635	106	654	109	617	113	634	116
37	Mount Stewart	478	413	477	425	436	383	449	394	404	347
48	Bunbury	1,973	527	2,063	584	2,123	655	2,185	730	2,244	807
49		1,001		1,058		1,089		1,065		1,094	
50		792		741		763		729		749	
57		879		847		872		841		864	
58		498		530		545		505		519	
60		305		318		327		281		289	
62		573		583		545		561		519	
65		941		900		872		897		864	
67		1,101		1,111		1,144		1,121		1,151	
Sub-total		21,547	29,561	21,858	31,002	22,332	32,067	22,311	33,676	22,743	34,752
Total		51,135		52,860		54,399		55,987		57,495	

TABLE 1 (Cont'd)

POPULATION PROJECTIONS OF P.E.I. 1971 - 1991

LOT	COMMUNITY	1971 Rural	1971 Urban	1976 Rural	1976 Urban	1981 Rural	1981 Urban	1986 Rural	1986 Urban	1991 Rural	1991 Urban
Kings											
38		442		425		408		390		371	
39	Indian Reserve	714	16	701	18	705	19	686	20	668	20
40	Morell	593	387	591	388	594	390	593	409	594	408
41	St. Peters	403	370	406	364	408	371	390	372	390	371
42		393		388		390		390		390	
43		806		812		817		815		817	
44		770		775		780		778		780	
45	Souris	472	1,393	425	1,643	427	1,726	408	1,723	390	1,727
46		443		462		464		464		464	
47		822		369		186		186		186	
51		526		535		538		538		530	
52		743		757		780		778		798	
	Montague		1,608		1,828		1,949		2,019		2,061
53		370		369		371		371		371	
	Georgetown		767		812		835		853		854
	Cardigan		266		258		260		261		260
	Royalty		137		129		130		131		130

TABLE 1

POPULATION PROJECTIONS OF P.E.I. 1971 - 1991 (Cont'd)

LOT	COMMUNITY	1971 Rural	1971 Urban	1976 Rural	1976 Urban	1981 Rural	1981 Urban	1986 Rural	1986 Urban	1991 Rural	1991 Urban
54		434		443		445		426		427	
55		561		554		557		556		557	
		488		462		445		445		427	
59		841		849		872		871		891	
61		853		849		854		852		854	
63		859		849		835		815		798	
64		928		923		928		945		947	
	Murray River		478		498		501		520		520
	Murray Harbour		367		388		390		409		408
66		180		185		186		186		167	
Sub-total		12,641	5,789	12,129	6,331	11,990	6,571	11,885	6,699	11,825	6,741
Total		18,430		18,460		18,561		18,584		18,566	
SUMMARY											
Prince		23,231	18,851	22,907	19,709	22,749	20,292	22,282	21,103	21,964	21,666
Queens		21,574	29,561	21,858	31,002	22,332	32,067	22,311	33,676	22,743	34,752
Kings		12,641	5,789	12,129	6,331	11,990	6,571	11,885	6,699	11,825	6,741
Total		57,446	54,201	56,894	57,042	57,071	58,930	56,478	61,478	56,532	63,159
Provincial Population		111,647		113,936		116,001		117,956		119,691	

TABLE 2

DOMESTIC, COMMERCIAL, TOURIST & INSTITUTION
WASTE GENERATION PROJECTION (TONS)

LOT	1971	1976	1981	1986	1991
1	1,089	1,147	1,222	1,292	1,388
2	787	860	931	981	1,070
3	258	262	285	286	313
4	939	1,024	1,098	1,193	1,261
5	384	404	436	456	496
6	709	787	887	948	1,029
7	256	256	260	260	263
8	255	256	278	280	307
9	164	188	185	200	198
10	136	123	133	123	134
11	258	275	281	299	330
12	381	410	408	460	460
13	336	359	388	397	410
14	305	315	323	327	335
15	661	715	773	847	921
16	376	403	436	470	514
17	2,015	2,343	2,616	2,939	3,230
18	408	432	455	465	481
19	1,035	1,133	1,267	1,377	1,520
20	280	279	314	315	349
21	345	355	389	401	442
22	217	244	273	297	334
23	469	489	549	572	633
24	872	979	1,098	1,201	1,330
25	353	375	414	421	458
26	505	550	595	630	686
27	613	648	711	759	838
28	857	942	1,034	1,105	1,219
29	557	598	653	693	763
30	286	297	330	325	363
31	564	629	706	772	855
32	811	929	1,068	1,195	1,355
33	644	714	800	874	967
34	549	622	686	753	838
35	359	400	441	484	539

TABLE 2 (Cont'd)

LOT	1971	1976	1981	1986	1991
36	299	326	366	372	413
37	347	379	369	405	391
38	168	174	180	183	189
39	270	288	311	325	344
40	412	441	482	512	551
41	309	333	358	381	411
42	149	159	172	183	199
43	330	357	392	416	449
44	339	372	398	428	460
45	765	910	1,033	1,087	1,164
46	177	199	213	232	251
47	312	151	82	87	95
48	950	1,085	1,222	1,370	1,556
49	400	455	501	533	591
50	333	333	374	379	419
51	205	225	242	258	280
52	1,081	1,293	1,446	1,594	1,773
53	601	659	718	776	840
54	165	182	196	200	218
55	230	244	267	284	306
56	190	194	200	214	222
57	369	381	427	437	484
58	189	217	240	237	265
59	353	382	427	453	499
60	128	143	160	146	162
61	316	340	367	392	427
62	241	262	267	292	291
63	326	348	367	383	407
64	674	742	800	881	956
65	433	450	462	511	536
66	68	76	82	87	85
67	429	467	515	538	599
Summerside	6,702	7,450	8,084	8,898	9,888
Charlottetown	19,203	21,780	24,230	26,920	29,925
TOTAL	59,496	62,539	68,673	74,791	82,275

TABLE 3

INDUSTRIAL WASTE GENERATION PROJECTION (TONS/YEAR)

LOT	1971	1976	1981	1986	1991
1	84	82	81	108	107
2	121	123	145	143	165
3	61	64	65	67	74
4	125	125	148	149	168
5	86	94	95	100	110
6	219	245	272	292	312
7	138	141	139	141	142
8	179	179	194	195	215
9	40	47	43	48	47
10	29	27	27	26	29
11	1	1	1	1	1
12	4	4	4	4	4
13	34	34	43	41	39
14	64	69	66	70	72
15	83	83	101	102	119
16	139	147	159	170	192
17	318	343	416	438	507
18	249	265	275	283	289
19	493	554	595	662	733
20	55	57	59	62	70
21	39	37	46	44	52
22	5	5	5	6	6
23	11	11	11	11	12
24	21	22	23	24	24
25	397	418	457	470	508
26	442	486	517	542	597
27	442	465	512	559	592
28	578	635	703	751	819
29	186	195	214	235	254
30	24	23	30	28	29
31	151	171	191	212	233
32	77	83	109	115	121
33	61	63	82	84	86
34	98	118	122	141	145
35	28	29	29	40	41
36	22	22	23	29	30
37	36	36	41	42	38
38	35	38	37	39	41
39	37	36	43	42	48
40	88	98	98	108	118

TABLE 3 (cont'd)

LOT	1971	1976	1981	1986	1991
41	93	101	109	114	121
42	24	23	27	27	31
43	177	195	204	220	237
44	23	23	23	31	31
45	205	248	280	298	318
46	350	393	422	455	492
47	362	173	95	102	110
48	75	79	83	117	122
49	110	127	142	149	164
50	222	222	244	255	277
51	116	128	135	145	156
52	470	569	627	699	772
53	31	31	32	32	48
54	22	22	27	26	30
55	34	33	39	39	45
56	29	28	31	31	34
57	167	169	192	202	216
58	10	11	11	10	16
59	50	51	61	61	71
60	88	99	111	101	113
61	9	8	9	9	9
62	11	12	11	11	16
63	17	17	17	16	24
64	177	181	182	187	188
65	104	108	113	126	130
66	0	0	0	0	0
67	253	278	309	325	357
S'Side	33	33	33	33	33
Ch'Town	87	87	87	87	87
TOTAL	8,651	9,124	9,877	10,532	11,437

TABLE 5

DISPOSAL SITE COSTS

NOTES:

- Typical site conditions were developed for estimating disposal site costs. Sites were assumed to be moderately wooded, adjacent to paved highways, and have slopes of 2%-5%. Soil conditions were adequate for normal groundwater protection, (if trenching did not exceed 6 feet) and for refuse cover.
- Method of operation to be sanitary landfill, requiring compaction and 6" of soil cover of refuse within 24 hours of dumping.
- Sites will be operated on the trench method with an average depth of trenching of 6 feet, providing a refuse disposal capacity of 2,660 Tons per acre. On larger sites (over 1,000 Tons per year) an above grade "area" lift is permitted providing an additional capacity of 8,000 Tons per acre.
- A compacted density of 780 lbs./cu. yd. was assumed.
- All sites will have a Bulk Waste Disposal area of approximately 20% of developed area.
- Smaller "local" sites will be open for supervised public dumping for at least two days per week for an aggregate of not less than 12 hours. Larger sites will be operated for 8 hours per day, 5"1/2 days per week.
- Sites will maintain visual buffer from adjacent lands, access roads will be paved and be provided with attractive entrances restricting access to operating hours.

TABLE 5 (cont'd)

- Site maintenance will be provided for smaller sites (receiving less than 500 T/year) by equipment moved between sites, with a minimum of 6 hours per site per week (including travel time). Maintenance increases with the quantity of wastes. Custom maintenance is provided for seasonal heavy work, snow removal, etc. beyond the capability of system equipment.
- On-site buildings are provided for equipment storage.
- A minimum of one groundwater monitoring well is provided for all sites.
- Capital cost amortized at 8% for the life of site (10 years).

UNIT COSTS

CAPITAL:		
Monitoring wells:	-50 acre site	1 @ $1,000
	50+ "	2 @ $1,000
Test wells:	1 well/5 acres	@ 100
Land acquisition:		@ 500/acre
Survey and Legal:	-10 acres	1,000
	10-50 acres	1,500
	50+ acres	2,000
Surface Water Control:		@ 1/ft.
Access Roads; Paving		@ 14/ft.
Stabilizing		@ 8/ft.
On-Site Buildings	$12,000 - $20,000	
Engineering	10% of Capital	
FINISHING:	$1,000 acre/developed acre	
OPERATING:		
Manpower wage + 50%:	Labourer	$3.00/hr.
	Attendant	$4.50/hr.

TABLE 5 (cont'd)

Machinery Rates: includes - depreciation, interest, taxes, insurance, repairs, maintenance, supplies, fuels, lubricants, single operators wages, profits, etc. (from Department of Public Works and Highways "Machinery Rates" 1972)

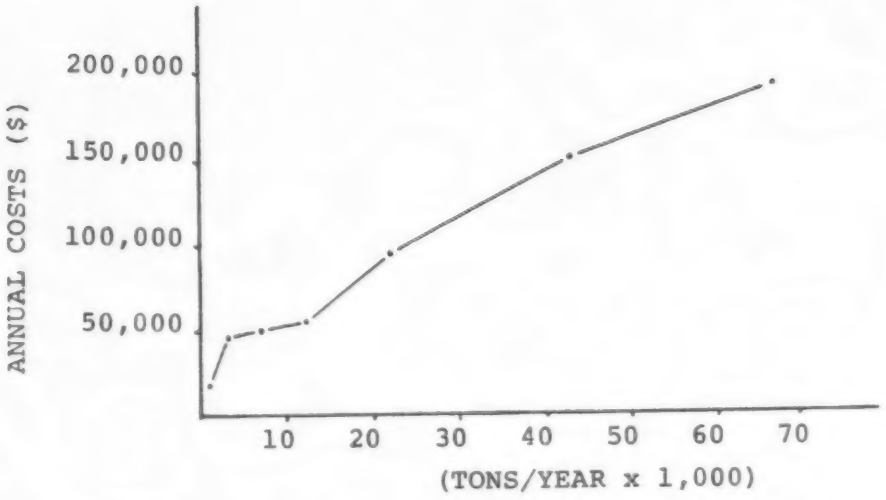
D 4	$15/hr
D 6	$20/hr
941 B	$17/hr
951 C	$20/hr
955 L	$23/hr
DW 20	$40/hr
H 90 C	$25/hr
816	$22/hr* (Compactor)

* Estimate provided by local dealer.

TABLE 5

SANITARY LANDFILL COSTS

	SIZE TOTAL ACRES	10 ac	11 ac	17 ac	25 ac	38 ac	68 ac	100 ac	
	CAPACITIES T/Y	425	3,600	7,500	12,500	22,000	44,000	68,600	BULK
(a)	CAPITAL COSTS:								
	Monitoring Well	1,000	1,000	1,000	1,000	1,000	2,000	2,000	-
	Test Wells	200	300	400	600	800	1,400	2,000	200
	Land Acquisition	5,000	5,500	8,500	12,500	19,000	34,000	50,000	5,000
	Survey & Legal Fees	1,000	1,500	1,500	1,500	1,500	2,000	2,000	1,000
	Land Clearing	1,200	2,400	5,400	9,000	15,000	30,000	36,000	3,000
	Surface Water Control	500	1,200	2,000	2,500	2,800	4,000	5,000	500
	Gates & Fencing	1,000	1,500	1,500	2,000	2,000	2,000	3,000	2,000
	Access Road Paving	4,200	7,000	8,400	10,500	15,400	21,000	54,000	-
	Stabilizing	1,600	1,600	2,000	2,400	1,600	3,200	4,000	4,800
	Buildings	4,500	12,000	12,000	12,000	12,000	15,000	20,000	-
	Engineering	2,020	3,400	4,270	5,400	7,110	11,460	17,800	1,650
	TOTAL CAPITAL COSTS	22,220	37,400	46,970	59,400	78,210	126,060	195,800	18,150
(b)	FINISHING COSTS:	2,000	4,000	10,000	15,000	25,000	50,000	75,000	5,000
(c)	OPERATING COSTS:								
	Labour	-	-	-	-	7,152	7,152	14,300	-
	Attendant	2,800	-	-	-	10,728	10,728	10,728	860
	Misc. Equipment	50	100	100	150	300	400	500	-
	Machinery	4,500	34,000	34,000	34,000	40,000	38,000	44,000	600
		2,000	-	-	-	-	50,000	38,000	-
	Custom Earth Work	1,000	1,800	4,000	6,000	12,000	12,000	40,000	300
	Annual Maintenance	2,500	3,200	3,500	5,000	7,000	7,000	9,000	200
	TOTAL ANNUAL OPERATING COSTS	12,850	39,100	41,600	45,150	77,180	125,280	156,528	1,960
	ANNUAL CAPITAL COSTS Authorized @8%/10yr.	3,330	5,610	7,050	8,910	11,730	18,910	29,370	2,720
	ANNUAL FINISHING COST Sinking Fund Factor 7%/10 yrs.	140	280	700	1,050	1,750	3,500	5,250	350
	TOTAL ANNUAL COSTS: (OPER. + CAP. REC)	16,320	45,000	49,350	55,100	90,660	147,690	191,150	5,030
	($/TON)	38.40	12.50	6.60	4.41	4.12	3.35	2.78	



TOTAL COST GRAPH FOR REFUSE TONNAGES CONSIDERED

TABLE 6

COLLECTION - TRANSFER VEHICLE COSTS

NOTES:

- capital costs are estimated F.O.B. Charlottetown including 8% provincial and 12% federal tax.
- capital costs have been amortized at 8% for 5 years for all vehicles and equipment.
- administration cost included at 3% of capital costs.
- maintenance and repairs at 10% of capital.
- operators wages estimated at current rates, plus 50% to cover workman's compensation, sick leave, vacation pay, etc.
- in calculating haul cost an average highway speed of 30 mph was assumed.
- load capacities of vechicles and containers are based on attaining densities of 500 lb./cu.yd. for the compacted refuse and 225 lb./cu.yd. for the uncompacted refuse, with the exception of a rural refuse packer service where conditions limit the daily capacity to 4.1 Tons.

TABLE 6

COLLECTION - TRANSFER VEHICLE COSTS

	22 cy Collector Packer (1 man)	22 cy Collector Packer (2 man)	25 cy Front End Loader	20 cy Roll Off Hoist	40 cy Roll Off Hoist
CAPITAL COSTS					
- Special Equipment			13,800	8,400	11,500
- Chassis			18,000	14,000	18,500
TOTAL CAPITAL COST	30,000	30,000	31,800	22,400	30,000
F.O.B. Ch'Town (inc. Fed. & Prov. Tax)					
Capital Recovery (8% for 5 yrs. crf=0.25)	7,500	7,500	7,950	5,600	7,500
ANNUAL OPERATING COST					
Insurance	375	425	350	350	350
Registration	300	300	300	300	300
Tax	300	300	320	225	320
Administration (3% of delivered capital)	900	900	950	675	950
Fuel	3,700	3,700	3,500	3,000	3,400
Tires	2,000	2,000	2,000	2,000	2,000
Hydraulics	2,000	2,000	2,500	1,500	2,000
Maintenance (10% of delivered capital)	3,000	3,000	3,180	2,250	3,200
Operator (wage +50%)	12,000	24,000	12,000	12,000	12,000
TOTAL ANNUAL OPERATING COST	$24,575	$36,625	$25,100	$22,300	$24,520
TOTAL ANNUAL COST (OPERATING + CAPITAL RECOVERY)	$32,075	$44,125	$33,050	$27,900	$32,020
Operating Cost $/hr @2,000 hr/yr @ 30 m.p.h.	16.04 $/hr	22.06 $/hr	16.50 $/hr	14.00 $/hr	16.00 $/hr
	53¢/mile	74¢/mile	55¢/mile	47¢/mile	53¢/mile
Load (tons)	4.1	5.0	5.6	3.0	6.0
HAUL COSTS	13¢/T-mile	14.7¢/T-mile	10¢/T-mile	15.6¢/T-mile	9¢/T-mile

TABLE 7

SUMMARY - REFUSE HAUL & DISPOSAL ECONOMIC EVALUATION

(Averaged 10 year costs)

SCHEME	SITE	HAUL		DISPOSAL					TOTAL ANNUAL COSTS	VARIATION	
		Suburban	Urban		Operating	Developing	Finishing				
		$/yr.	$/T	$/T	$/Y	$/Y	$/Y	$/T	$/Y	$/T	%
1.	Q-46	244,130	173,544	6.24	183,706	36,917	6,500	3.39	644,800		
	(5 bulk)								25,000		
									669,900	10.00	+22%
2.	P-5	81,355	22,101	4.28	81,100	11,979	2,300	3.95	198,835		
	Q-14	94,784	65,695	3.75	136,960	24,852	4,200	3.88	326,491		
	(4 bulk)								20,000		
									545,326	8.16	0%
3.	P-28	23,914	-	2.93	39,100	8,191	700	5.88	71,971		
	Q-46	54,333	173,555	4.91	136,960	20,033	4,200	3.47	389,080		
	K-20	44,730		3.62	39,100	9,567	1,300	4.04	94,698		
	(3 bulk)								15,000		
									570,749	8.54	+ 4%
4.	P-28	12,038		2.04	31,100	11,934	600	8.80	63,673		
	P-5	21,833	22,101	2.74	81,100	11,934	1,300	5.19	145,069		
	Q-14	61,353	65,695	3.27	133,810	24,852	3,800	4.19	289,510		
	K-38	9,692		2.45	39,100	5,867	400	11.48	55,059		
	(2 bulk)								10,000		
									563,311	8.42	+ 3%

TABLE 7 (Cont'd)

SUMMARY - REFUSE HAUL & DISPOSAL ECONOMIC EVALUATION

(Averaged 10 year costs)

SCHEME	SITE	HAUL			DISPOSAL				TOTAL ANNUAL COSTS		VARIATION
		Suburban	Urban		Operating	Developing	Finishing				
		$/Yr.	$/Y	$/T	$/Y	$/Y	$/Y	$/T	$/Y	$/T	%
5.	P-28	12,038		2.04	39,100	11,934	600	8.80	63,673		
	P-5	81,355	22,101	4.28	81,100	11,979	2,300	3.95	198,835		
	Q-46	15,378		2.24	39,100	18,672	3,000	8.88	76,149		
	Q-14	8,572	65,695	2.77	88,408	5,837	3,800	3.52	169,042		
	Q-10	14,092		2.79	39,100	6,475	500	9.12	60,161		
	K-38	9,692		2.45	39,100	5,807	400	11.48	55,059		
									622,919	9.32	+ 14%
INCINERATION		(20 Year Life)									
2.	P-5	86,817	24,283	4.25	285,559	164,491	0	17.22	561,151		
	Ch'town	99,407	49,868	3.13	232,778	345,279	0	12.14	727,333		
	(4 bulk)								20,000		
									1,308,484	19.58	+139%

TABLE 8

1976 REFUSE GENERATION QUANTITIES

Refuse generation quantities were developed for representative year 1976, using the generation rates established in Section

All areas were recognized as generating domestic refuse, however commercial, institutional and tourism wastes were considered to be generated in municipalities and were allocated in proportion to apparent commercial, institutional and tourist activity.

TABLE 8

REFUSE GENERATION (1976)

AREA	POPULATION	TYPE	RATE (LB/CAP/DAY)	TON/WK.	TON/YR.
City of Ch'town	19,776	DOM	1.45	100.4	5,220.8
		COMM	2.26	156.4	8,134.3
		INST.+TOUR & MISC.	2.21	153.0	7,954.3
		MUN.	.11	7.6	396.0
				417.4	21,705.4
Ch'town Environs	8,731	DOM	1.45	44.3	2,304.1
		COMM	2.26	69.1	3,591.2
		INST + TOUR & MISC.			
		MUN.			
				113.4	5,895.3
Town of S'Side	9,675	DOM	1.45	49.1	2,553.2
		COMM	2.26	76.5	3,979.5
		INST + TOUR & MISC.	.38	12.9	669.1
		MUN.	.11	3.7	193.7
				142.2	7,395.5
S'Side Environs	2,729	DOM	1.45	13.8	720.2
		COMM	2.26	21.6	1,122.5
		INST + TOUR & MISC.			
		MUN.			
				35.4	1,842.7
Rural Municipalities	16,131	DOM	1.45	81.9	4,257.0
		COMM	1.50	84.7	4,403.8
		INST + TOUR & MISC.	.76	42.9	2,231.2
		MUN.			
				209.5	10,892.0
Rural	56,906	DOM	1.45	288.8	15,017.5
		COMM			
		INST + TOUR & MISC.			
		MUN.			
				288.8	15,017.5
PROVINCIAL TOTAL				1,206.7	62,748.4

TABLE 9

COST OF REFUSE CONTAINERS

NOTES:

- Provincial and Federal Sales Tax included.
- Capital Costs are depreciated over 5 years at 8%.
- Annual operating costs include: painting, cleaning and repairs. Estimated at 7% of capital cost.

CAPITAL COST	2 CY $	4 CY $	20 CY $	40 CY $
- Unit Price	212.00	247.00	1,800.00	2,375.00
- Tax (8% Prov. + 12% Fed.)	44.00	52.00	380.00	499.00
- Delivery	50.00	70.00	300.00	300.00
TOTAL CAPITAL COST	306.00	369.00	2,480.00	3,174.00
Capital recovery (8% for 10 yrs, crf=0.15)	76.60	92.25	620.00	794.00
Operating Costs				
- Operating 7% of delivered capital cost	21.40	25.85	174.00	222.00
TOTAL ANNUAL COSTS (OPERATING + CAPITAL RECOVERY)	$98.00	$118.10	$794.00	$1,016.00

TABLE 10

DOMESTIC REFUSE COLLECTION COSTS

NOTES:

- Estimates are based on the operation of a representative 22 cu.yd. side loading compacter providing a once-weekly curb-side service .

- Vehicle collection capacity is based on an average 45 lb. per household per week and does not include collection of bulk items or special seasonal requirements as spring cleanup.

- In urban areas of Charlottetown and Summerside a two man crew can achieve a daily collection capacity of 600 units @ 45 lb. per or 12.3 Ton/day.

- In rural municipalities a two man crew, because of decreased housing densities can achieve a daily collection capacity of 500 units @ 45 lb.per or 10.3 Ton/day.

- In rural areas a single man crew will be adequate and can achieve a daily collection capacity of 260 units @ 45 lb per. or 4 Ton/day.

- Sufficient flexibility was considered to exist in the system to absorb an increase in design capacity of up to 20%; however, capital and operating costs were estimated on design capacities.

TABLE 10

DOMESTIC REFUSE COLLECTION COSTS

REGION	Refuse Quantities[a]		Collection Pickups/day	Collection Capacity of Vehicle	Number of Vehicles Required[b]		Operating Cost of Vehicles	Total Annual Cost	
	T/W	T/D	45#/pickup	T/D			$/hr	$/yr	$/T
		@5.5 day/wk.					(Table 6)	@44 hr/wk.	
Ch'Town & Area	145	26.4	600	12.3	2.1		22.04	107,411	14.24
S'Side & Area	63	11.4	600	12.3	.9	(1)	22.04	50,427	15.40
Rural Municip-alities	82	15.	500	10.3	1.4		22.04	72,616	17.05
Rural	289	53.	260	4.1	12.9		16.04	477,094	31.75

[a] Refuse quantities developed in Table 8.

[b] Use of calculated fractional vehicle requirements was considered acceptable for derivation of estimated costs.

TABLE 11

COMMERCIAL, INSTITUTIONAL, ETC. COLLECTION COSTS

NOTES:

- Estimates are based on the operation of a representative 25 cu.yd. front end loading compaction vehicle providing twice weekly service to 4 cu.yd. refuse containers.

- An increase of 50% above estimated refuse quantities was considered desirable for design capacity to provide for unequal distribution within the system, seasonal fluctuations and a safety margin.

- In urban areas of Charlottetown and Summerside, a Front End Loader can achieve a Daily Collection capacity of 22 T/D.

- Interim route travel time is estimated at 6 min. per container.

- Service time is estimated at 4 minutes per container.

- The uncompacted density of refuse in Containers is 225/cu.yds or 0.45Tons per container.

- The compacted density of refuse in the vehicle is 500/cu/yds.

- In rural municipalities because of increased route travel the daily collection capacity is reduced to 16 T/D.

TABLE 11

COMMERCIAL - INSTITUTIONAL - ETC. COLLECTION COSTS
(4 cu.yd. container + 25 cu.yd. Front End Loader)

	Refuse Quantities		No. of	Vechicles		Total Annual Costs		Total Cost	
	Estimate	Design[a]	Containers[b]	Capacity[c]	Number Required[d]	Container[e]	Vechicle[f]		
	T/W	T/W		T/W		$/Year	$/Year	$/Year	$/Year
Ch'town & Area	380	570	634	121	3.1	75,000	117,030	192,030	9.72
S'Side & Area	111	167	186	121	1.0	22,000	37,752	59,752	10.35
Rural Municipal	128	192	213	88	1.5	25,000	56,628	81,628	12.26

a. Estimated generation quantities increased by 50% for design safety margin.
b. Refuse containers of .45 Ton capacity are serviced twice weekly, therefore storage must be provided for one half weekly generation.
c. Weekly collection capacity of vechicles are derived from daily capacities of 22 Tons/ Day and 16 Tons/ Day for urban and rural conditions respectively, for a 5.5 day work week.
d. Use of calculated fractional vehicle requirements was considered acceptable for derivation of estimated costs.
e. Costs developed from unit costs of 4 cy. containers in Table 9.
f. Vechicle costs were developed from unit hourly costs in Table 6 extended to a 44 hour work week.

TABLE 12

BULK CONTAINER TRANSFER SITES

NOTES:

- Container transfer sites are located adjacent to paved all-weather highways or streets to provide convenient access to the area served. While soil conditions are not critical as far as landfill sites are concerned, a visual buffer of natural vegetation is preferred.
- Paved roads and attractive entrances provide access to an elevated ramp, placing the top of the bulk containers at "tail gate level" for convenient refuse handling.
- Daily site maintenance will be provided by a mobile crew servicing a number of sites to insure site cleanliness.
- TYPICAL SITES COSTS: Adapted from Table 5

CAPITAL			
Land Acquisition	1 acre	$ 500	
Survey & legal fees		700	
Land preparation		900	
Gate & Fencing		1,000	
Paving & Cribwork 500' @ $14		7,000	
Engineering (10%)		1,000	
TOTAL CAPITAL		11,100	
CAPITAL RECOVERY 8%/10 yr.			1,665
FINISHING COSTS		500	
SINKING FUND 7% @10 yr.			35
ANNUAL OPERATING COSTS			
Labour (Average 1 hr./day)		3,129	
Vehicle Maintenance & Equipment		1,300	
TOTAL ANNUAL OPERATING COST			4,429
TOTAL ANNUAL COST (OPERATION & CAPITAL RECOVERY)			$ 6,130

TABLE 13

DOMESTIC, COMMERCIAL, INSTITUTIONAL + BULK CONTAINER SERVICE COSTS

NOTES:

- Estimates are based on providing 23 bulk container transfer sites for rural municipalities and 30 sites serving remaining rural areas.

- Sites are provided with a minimum of one 40 cu.yd. container at all times. Additional containers as required are provided twice weekly for "dump days".

- An increase of 50% above estimated refuse generation was used in design to provide adequate capacity for seasonal fluctuations and unequal distribution within the system.

- Containers to be thoroughly cleaned and disinfected at disposal site before returning to service.

- Containers are removed for dumping at regional disposal sites by special vehicles. Scheduling container removal will insure that 70% of the refuse is removed within 24 hours of disposal with no refuse remaining on site for more than 4 days.

- Analysis of container handling has shown that most economical service is provided when sufficient containers to provide 60% of total weekly capacity are maintained in service.

TABLE 13

DOMESTIC - COMMERCIAL - INSTITUTIONAL BULK CONTAINER TRANSFER COSTS

	No. of Sites	Refuse Quantities Estimate	Refuse Quantities Design[a]	No. of Containers[b]	Vechicles Capacity	Vechicles Number Required[c]	Annual Component Costs Cont.[d]	Annual Component Costs Sites[d]	Annual Component Costs Vehic[d]	Total Costs	
		T/W	T/W		Cont/Day		$/Year	$/Year	$/Year	$/year	$/Ton
							TABLE 9	TABLE 12	TABLE 6		
Rural Municipal	23	210	315	34	5	1.8	34,544	141,000	71,884	247,428	22.70
Rural	30	289	435	46	5	2.4	46,736	184,000	95,846	326,582	21.75

a. Estimated generation quantities increased by 50% for design safety margin.
b. Number of containers to provide 60% weekly design capacity, plus one per vechicle
c. Use of fractional vechicle requirements was considered acceptable for derivation of estimated costs.
d. Figure in this column was developed using unit costs developed in the indicated Table.